



CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

AMENDMENTS
TO
THE WATER QUALITY CONTROL PLAN
FOR THE SACRAMENTO RIVER AND
SAN JOAQUIN RIVER BASINS
FOR
TEMPERATURE
AT
DEER CREEK
EL DORADO & SACRAMENTO COUNTIES

STAFF REPORT
AND
FUNCTIONAL EQUIVALENT DOCUMENT



***Draft Report
January 2003***

State of California

California Environmental Protection Agency

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EXECUTIVE SUMMARY

This Staff Report proposes an amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan) for Deer Creek temperature. The existing Basin Plan temperature objective, applicable to Deer Creek, is as follows:

“At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature.”

The site-specific temperature objectives proposed for Deer Creek are as follows:

<i>Date</i>	<i>Daily Maximum (°F)^a</i>	<i>Monthly Average (°F)^b</i>
<i>January and February</i>	<i>63</i>	<i>58</i>
<i>March</i>	<i>65</i>	<i>60</i>
<i>April</i>	<i>71</i>	<i>64</i>
<i>May</i>	<i>77</i>	<i>68</i>
<i>June</i>	<i>81</i>	<i>74</i>
<i>July through Sept.</i>	<i>81</i>	<i>77</i>
<i>October</i>	<i>77</i>	<i>72</i>
<i>November</i>	<i>73</i>	<i>65</i>
<i>December</i>	<i>65</i>	<i>58</i>

a Maximum not to be exceeded.

b Defined as a calendar month average.

Issue Overview

Deer Creek is a small creek draining the lower woodlands of the western Sierra Nevada foothills in El Dorado and Sacramento counties. In 1974, the El Dorado Irrigation District (District) began operating the Deer Creek Wastewater Treatment Plant (DCWWTP), located approximately 2.2 miles south of Highway 50, near the town of Cameron Park. Currently, discharge of tertiary-treated effluent from the DCWWTP constitutes the majority of Deer Creek flow below the point of discharge during the low-flow, summer/fall period of the year. Deer Creek is a seasonally effluent-dominated water body (EDW) below the point of discharge from the plant during the June through October period, and the early portion of November in most years.

The Basin Plan 5°F temperature objective, stated above, is the current temperature objective applicable to Deer Creek and is included as a receiving water limitation in the District's NPDES permit for the DCWWTP. The Basin Plan temperature objective is not strongly supported by current science regarding the effects of temperature on aquatic life (the beneficial use most sensitive to creek temperature), nor is it consistent with U.S. EPA's current approach to regulating temperature in ambient waters. The minimal dilution offered by the receiving water during the late spring, summer, and fall periods of the year (and other periods during drier conditions) results in a situation where the

Basin Plan temperature objective cannot be consistently achieved downstream of the point of effluent discharge.

Although the current Basin Plan temperature objective cannot be met year-round by the DCWWTP, available biological and temperature data for the creek show that discharges from the plant are not having adverse thermal affects on downstream aquatic life. Biological surveys have shown that the creek supports equivalent or more diverse communities of aquatic organisms downstream of the DCWWTP compared to upstream areas.

Approach to Issue Resolution

In addition to the development of site-specific temperature objectives for Deer Creek, this Staff Report evaluates the following additional options for resolving the regulatory issue associated with temperature at Deer Creek.

- Option 1 – Additional Treatment Facilities at the DCWWTP
- Option 2 – Effluent Reuse
- Option 3 – Connect to Sacramento Regional Wastewater Treatment Plant
- Option 4 – Deer Creek Pool Habitat Enhancement
- Option 5 – Deer Creek Riparian Habitat Enhancement
- Option 6 – Quarry Water Discharge into Deer Creek

In developing the Basin Plan Amendment Option, Regional Board staff implemented a “two-step” process to develop scientifically defensible temperature objectives for Deer Creek. The first step was to compile the available scientific literature pertaining to thermal requirements of the fish and benthic macroinvertebrates documented to occur in Deer Creek. Temperature criteria were derived for a number of Deer Creek’s resident fish species, and their relatives (i.e., same genus) using U.S. EPA’s current temperature criteria derivation equations (USEPA 1986; 1999).

The second step involved compiling available biological and temperature data to characterize the creek’s biological diversity, structure, and condition and its historic and current seasonal temperature regime, both upstream and downstream of the DCWWTP. Data from five fish surveys and two benthic macroinvertebrate surveys conducted on Deer Creek between 1993 and 2000, each of which included sites above and below the DCWWTP, were used to characterize the creek’s aquatic ecology. Available temperature data monitored immediately upstream and downstream of the DCWWTP also were compiled for a number of hydrologic year types. The site-specific biological and temperature data were then integrated with the literature thermal requirement data to establish a sound scientific basis from which to propose a set of seasonal temperature objectives that would protect and maintain Deer Creek’s existing and probable future aquatic life uses.

In short, compliance with the set of seasonal temperature objectives proposed would maintain a seasonal temperature regime within the creek that would be ecologically equivalent to the regime experienced in past years. The objectives proposed would maintain the creek’s temperatures at levels equivalent to those that have historically

occurred, which have, in part, established the creek's current biological characteristics. Deer Creek's fish and benthic macroinvertebrate communities are typical of Sierra foothill streams, and are in good condition. Biological surveys have documented that the DCWWTP's discharges are not adversely affecting the creek's biota. For the reasons stated, maintaining the creek's existing thermal conditions will provide an appropriate level of protection for the creek's aquatic life beneficial uses – the uses most sensitive to creek temperatures.

Justification for the Proposed Amendment

For scientific, environmental, and economic reasons, Regional Board planning staff propose the site-specific Basin Plan amendment over the other options evaluated.

The scientific evaluation of the issue revealed that it is primarily the *absolute temperatures* that occur in the creek, not the *change* in temperature relative to an upstream point, that affect aquatic life. In its 1972 water quality criteria, the U.S. EPA stated the following as part of the technical discussion presented regarding development of temperature criteria for the protection of aquatic life (USEPA 1973):

“Criteria for making recommendations for water temperature to protect desirable aquatic life cannot be simply a maximum allowed change from ‘natural temperatures.’ This is principally because a change of even one degree from an ambient temperature has varying significance for an organism, depending upon where the ambient level lies within the tolerance range [for that organism].”

The above statement remains consistent with EPA's current approach to the development of ambient water temperature criteria for temperature. The proposed site-specific temperature objectives developed for Deer Creek were based on the actual thermal requirements of the creek's aquatic life, rather than on a change from background conditions. This resulted in development of temperature objectives for the creek that are scientifically defensible. In its letter supporting the proposed amendment, dated February 14, 2001, the California Department of Fish and Game stated:

“Additionally, a U.S. Environmental Protection Agency (EPA) Gold Book analysis performed at the Board's request indicated that the acute and chronic criterion proposed for Deer Creek are lower [i.e., colder] than the calculated EPA acute and chronic criteria. The abundance of studies and analysis that have been performed in the Deer Creek watershed are some of the most if not the most extensive to date for a Central Sierra Nevada foothill stream. The Department is confident the temperature recommendations are appropriate.”

In the last (1999) triennial review of the Basin Plan, Regional Board planning staff identified, as a high priority, the need to develop solutions to water quality regulation problems common to EDWs. Among the most notable and widespread is the inability of municipal wastewater treatment plants discharging to EDWs to consistently comply with the current Basin Plan temperature objective. The proposed amendment provides a solution to this issue for Deer Creek.

Finally, the proposed site-specific temperature amendment minimizes potential environmental impacts to Deer Creek and other environments that could result from implementing other options evaluated herein while, at the same time, offering the most cost-effective resolution of the Deer Creek temperature issue.

Implications Associated with Adoption of the Proposed Amendment or Other Options

The amendment is proposed for Deer Creek only, rather than basin-wide or for all EDWs because, consistent with EPA's current recommended approach to regulating temperature it is tailored to the specific aquatic resources to be protected in the water body.

The proposed temperature objectives would maintain absolute temperatures, on both a short-term (acute) and long-term (chronic) basis, which would protect and maintain the creek's existing and probable future aquatic life and other beneficial uses. Adoption of the proposed amendment would not result in a degradation of Deer Creek water quality, with respect to temperature currently achieved or provided for in this water body, or those temperatures that would be achieved under the current Basin Plan temperature objective. The proposed objectives would not cause degradation of water quality in any downstream water bodies. Adoption of the proposed amendment would not result, either directly or cumulatively, in any significant environmental impacts to Deer Creek or other environmental resources within the region. Finally, the proposed amendment constitutes the most cost-effective option for resolving the Deer Creek temperature issue. The cost of developing and processing the amendment is estimated to be approximately \$0.3 million, which has been primarily funded by the District.

Although no significant environmental impacts were identified for Option 1 (Additional Treatment Facilities), its cost for implementation was estimated at \$2.9 million. Significant environmental impacts were identified for Option 2 (Effluent Reuse) and this option would not be expected to fully resolve the current regulatory issue. Significant environmental impacts also were identified for Option 3 (Connection to Sacramento Regional Wastewater Treatment Plant). Moreover, initial cost estimates for Options 2 (\$18 million) and Option 3 (\$38-52 million) indicate that their implementation would be cost prohibitive. This Staff Report concludes that Options 4 (Pool Habitat Enhancement) and Option 5 (Riparian Habitat Enhancement) would not be effective at resolving the temperature compliance issue. Insufficient information is available to fully evaluate the ability of Option 6 (Quarry Water Discharge) to resolve the current regulatory problem, identify associated environmental impacts, or estimate costs associated with its implementation. Finally, the options to the proposed amendment would not update or improve the scientific basis for the temperature objective applicable to Deer Creek.

Based on these findings, Regional Board staff believe that the proposed site-specific temperature objectives for Deer Creek: 1) are protective of the creek's existing and probable future beneficial uses; and 2) would resolve the current regulatory issue associated with temperature for this water body in a cost-effective and environmentally

sound manner. Consequently, Regional Board staff recommend that the Board adopt the site-specific temperature objectives for Deer Creek as proposed.

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LIST OF ACRONYMS

C.....	Celsius
CCR.....	California Code of Regulations
CDFG.....	California Department of Fish and Game
CEQA.....	California Environmental Quality Act
CFR.....	Code of Federal Regulations
cfs.....	cubic feet per second
CWA.....	Clean Water Act (Federal Water Pollution Control Act)
DCWWTP.....	Deer Creek Waste Water Treatment Plant
EDW.....	effluent dominated water body
EID.....	El Dorado Irrigation District
ESA.....	Federal Endangered Species Act
ESU.....	Evolutionary Significant Unit
F.....	Fahrenheit
FED.....	CEQA Functional Equivalent Document
FR.....	Federal Register
GC.....	California Government Code
JSA.....	Jones and Stokes Associates
mgd.....	million gallons per day
msl.....	mean sea level
NMFS.....	National Marine Fisheries Service
NPDES.....	National Pollutant Discharge Elimination System
OAL.....	Office of Administrative Law
SRCSD.....	Sacramento Regional County Sanitation District
SRWTP.....	Sacramento Regional Wastewater Treatment Plant
RWQCB.....	Regional Water Quality Control Board
SSBPA.....	Site-Specific Basin Plan Amendment
SWRCB.....	State Water Resources Control Board
SWRI.....	Surface Water Resources, Inc.
U.S. EPA.....	United States Environmental Protection Agency
USFWS.....	United States Fish and Wildlife Service
USGS.....	U.S. Geological Survey

1 INTRODUCTION

This Staff Report is the central planning documentation required by the California Water Code for adoption of Regional Water Quality Control Board, Central Valley Region (Regional Board) proposals for Basin Plan amendments. The report also serves as the California Environmental Quality Act (CEQA) environmental impact assessment document (Functional Equivalent Document) required for Basin Plan amendments.

The remainder of this section provides regulatory context for Basin Planning, defines the purpose and need for the revisions to the Basin Plan proposed in this Staff Report, the scope of proposed revisions, and the purpose and intended use of this Staff Report in the overall Basin Plan amendment process.

1.1 BACKGROUND

1.1.1 Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins

A Water Quality Control Plan, or Basin Plan, is the basis for regulatory actions by Regional Boards that are to be taken for water quality control. Each of the nine Regional Boards in California has adopted a Basin Plan for its geographic region.

The preparation and adoption of a Basin Plan is required by California Water Code Section 13240 and supported by the federal Clean Water Act (CWA). Section 303 of the CWA requires states to adopt water quality standards which consist of the designated uses of the navigable waters involved and the water quality criteria (referred to as “objectives” in California) for such waters based upon designated uses. A Basin Plan must consist of all of the following (Water Code Section 13240-13244):

- a) beneficial uses to be protected;
- b) water quality objectives;
- c) a program of implementation needed for achieving water quality objectives; and
- d) surveillance and monitoring to evaluate the effectiveness of the program.

Basin Plans are adopted and amended by the Regional Board using a structured process involving scientific peer review, full public participation, state environmental review, and state and federal agency review and approval.

It is the intent of the State Water Resources Control Board (State Board) and Regional Boards to maintain the Basin Plans in an updated and readily available edition that reflects the current water quality control program for each Basin. The Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin River Basins was first adopted in 1975. In 1989, a second edition was published. The second edition incorporated all the amendments that had been adopted and approved since 1975,

updated the Basin Plan to include new state policies and programs, restructured and edited the Basin Plan for clarity, and incorporated the results of triennial reviews conducted in 1984 and 1987. In 1994 a third edition was published that incorporated all amendments approved since 1989, including new state policies and programs, restructured and edited the Basin Plan to make it consistent with other regional and state plans, and substantively amended the sections dealing with beneficial uses, objectives, and implementation programs. The current edition (Fourth Edition 1998) incorporates two new amendments approved since 1994. One amendment deals with compliance schedules in permits and the other addresses agricultural surface drainage discharges.

Since publication of the Fourth Edition, the federal rules regarding U.S. EPA approval of water quality standards have changed. When a state adopts a water quality standard that goes into effect under state law on or after May 30, 2000, it becomes the applicable water quality standard only after U.S. EPA approval, unless the U.S. EPA promulgates a more stringent water quality standard for that state, in which case the U.S. EPA promulgated water quality standard is the applicable water quality standard for purposes of the CWA (40 CFR 131.20 & .21). This new regulation applies to all surface waters of the state.

1.1.2 Regulatory Authority and Mandates for Basin Plan Amendments

The State Board and the nine Regional Boards are the principal state agencies with regulatory responsibility for coordination and control of water quality. The Porter-Cologne Water Quality Control Act (California Water Code Section 13000 et seq.) establishes the requirement to adopt and revise state policies for water quality control. Basin Plans adopted by the Regional Boards must conform to these policies.

Authority for each Regional Board to formulate and adopt Basin Plans and periodically review the plans is provided in Section 13240 of the Water Code. However, a Basin Plan does not become effective until approved by the State Board (Water Code Section 13245), and the Office of Administrative Law (OAL) (Gov. Code Section 11353). If the amendment involves adopting or revising a standard that relates to surface water, it must also be approved by the U.S. EPA [40 CFR Section 131.20 & .21] before it goes into effect.

Section 303 of the CWA requires states to adopt water quality standards for surface waters “...from time to time...” and “...as appropriate....” Standards consist of designated uses and criteria (referred to as “objectives” in California) to protect those uses. These requirements are also found in the Code of Federal Regulations (CFR), primarily 40 CFR Part 130 (which covers water quality planning and management) and 40 CFR Part 131 (which covers water quality standards).

The Regional Board also must comply with the requirements of the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.) when amending the Basin Plan. The planning process for Basin Plans has been certified by the Secretary of Resources as a regulatory program pursuant to Public

Resources Code section 21080.5, and, CEQA Guidelines § 15251(g). Pursuant to Public Resources Code section 21080.5(c), the Basin Plan planning process is exempt from the provisions of the CEQA that relate to preparation of Environmental Impact Reports and Negative Declarations. In lieu of compliance with those provisions of CEQA, Section 9 of this Staff Report satisfies the requirements of State Water Resources Control Board Regulations for Implementation of CEQA, Exempt Regulatory Programs, which are found in the California Code of Regulations, Title 23, Division 3, Chapter 27, Article 6, beginning at Section 3775.

1.1.3 Purpose and Need for the Proposed Revisions to the Basin Plan

In its most recent (1999) triennial review of the Basin Plan, as required by the CWA, the Regional Board identified as a top priority the need to further develop solutions to water quality regulation problems common to effluent-dominated/dependent water bodies, like Deer Creek. Among the most notable and wide-spread water quality regulation problems for effluent-dominated water bodies is the inability of tertiary municipal wastewater treatment plants to consistently comply with NPDES permit's receiving water limitation for temperature, which is derived directly from the Basin Plan's current temperature objective. Moreover, the current temperature objectives is not strongly supported by the current science, nor is it consistent with U.S. EPA's current approach to deriving water temperature criteria for regulating temperature in ambient waters (see Sections 4.7.1 and **Appendix A**).

The focus of this Staff Report is to evaluate the existing water quality objective for Deer Creek temperature, determine if changes to this objective are appropriate, and, if so, propose and technically support such changes. This is consistent with the Regional Board's basin planning priority to address regulatory issues associated with effluent-dominated water bodies. The need for modifying the current Basin Plan temperature objective for Deer Creek was initially brought to Regional Board staff's attention through renewal of the Deer Creek Wastewater Treatment Plant's (DCWWTP) NPDES permit in 1997. The DCWWTP is owned and operated by the El Dorado Irrigation District (District).

Extensive discussions between Regional Board and District staff revealed that pursuing Site-Specific Basin Plan Amendments (SSBPA) for Deer Creek offered an appropriate and reasonable means of: 1) solving the current regulatory compliance problems associated with receiving water temperature in this seasonally effluent-dominated water body in a manner that maintains and protects beneficial uses; 2) updating the scientific basis for temperature objectives applicable to this water body; and 3) addressing the issue in the most cost-effective and environmentally sound manner. Potential alternative means of resolving this water quality regulatory issue at Deer Creek (e.g., Option 1 – Additional Treatment Facilities; Option 2 – Effluent Reuse; Option 3 – Connection to Sacramento Regional Wastewater Treatment Plant; and additional options considered but dismissed) are discussed in detail in Section 9 (Environmental Impact Review) of this Staff Report.

1.1.4 Background on Deer Creek and the Deer Creek Wastewater Treatment Plant

1.1.4.1 Deer Creek

Deer Creek is a small creek draining the lower woodlands of the western Sierra Nevada foothills in El Dorado and Sacramento counties. Deer Creek is the principal watercourse of its watershed, which covers approximately 17 square miles in the vicinity of Cameron Park. Its headwaters originate just north of Cameron Park Lake.

Precipitation and runoff sustain flows in Deer Creek during wet weather. Natural flow into Cameron Park Lake generally stops between May 15 and June 1 (SWRCB 1995). Leakage from the dam at Cameron Park Lake, springs, and urban runoff supply the creek's water downstream of the dam during the non-precipitation period of the year (SWRCB 1995). Summer base flows, upstream of the DCWWTP, have been documented in the range of 0.16-0.28 mgd (0.25-0.43 cfs) (SWRCB 1995). Unlike higher elevation creeks that receive perennial water supplies from snowpack, Deer Creek's small, low-elevation watershed does not hold snowpack (Beak 1990).

Deer Creek's terminal drainage is the Cosumnes River (Error! Reference source not found.). Deer Creek flows are intermittent throughout various reaches and may be subterranean in nature (e.g., near Scott Road) during low-flow summer and fall periods. Hence, the creek may still be hydraulically connected to the Cosumnes River by subterranean flow.

1.1.4.2 Deer Creek Wastewater Treatment Plant

In 1974, the District began operating the DCWWTP, which is located on Deer Creek approximately 2.2 miles south of Highway 50, near the town of Cameron Park. Currently, discharge of tertiary-treated effluent from the DCWWTP constitutes the majority of Deer Creek's flow below the point of discharge during the low-flow summer/fall period of the year. Consequently, Deer Creek is an effluent-dominated water body below the DCWWTP's point of discharge during much of the year, particularly the June through October period, with reaches downstream of the Latrobe Road Bridge being effluent dependent during the summer and fall months.

The DCWWTP discharges treated effluent to Deer Creek year-round, and produces recycled water for use in the County during the irrigation season of the year (e.g., typically May through October). In 1996-97, the District completed a total of \$16.8 million in improvements to the DCWWTP. Of this amount, \$9 million was for improvements to achieve reliable compliance at the existing capacity of 2.5 mgd average dry weather flow (ADWF), and the remainder was for expansion components to increase capacity of the secondary (wet-stream) systems to 3.6 mgd (ADWF). Expansion of the solids handling systems to 3.6 mgd capacity was completed in 1999-2000 at a cost of \$7.4 million. Therefore, approximately \$24 million has been expended on the DCWWTP since 1996 (OEMC 1995; W. Owen, President of OEMC, pers.

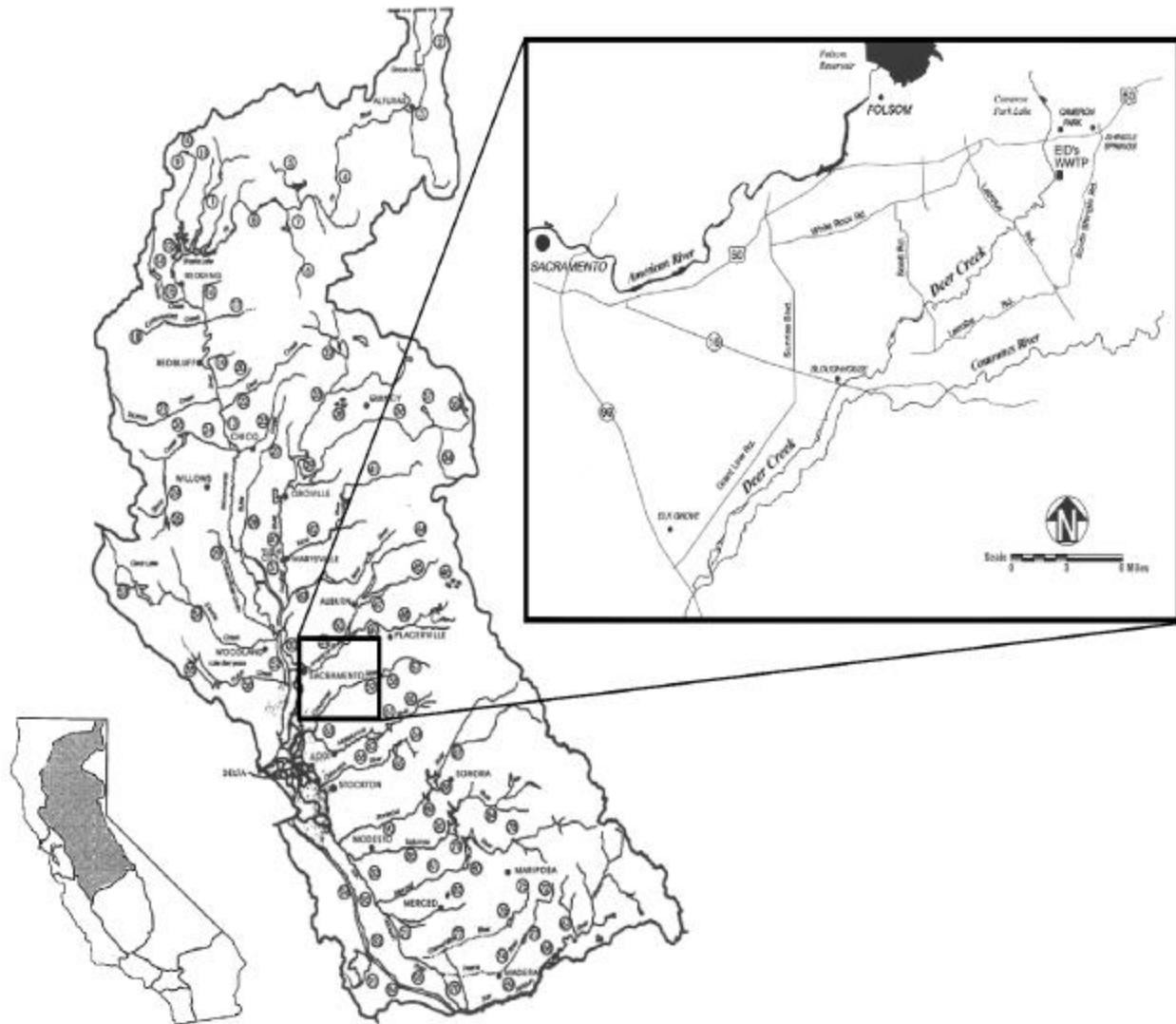


Figure 1. Location of Deer Creek within the San Joaquin River Basin of the Central Valley Region, California.

comm., August 17, 2000). Although its capacity has been expanded to 3.6 mgd (ADWF), the plant's current NPDES permit, issued in September 1999, limits the 30-day average dry weather discharge to Deer Creek to 2.5 mgd. This permit will be renewed during 2002 for an ADWF capacity above the current 2.5 mgd, but no greater than 3.6 mgd.

1.1.5 Scope of Revisions to the Basin Plan

The amendments to the Basin Plan proposed in this Staff Report are for Deer Creek only. If adopted, the proposed Basin Plan amendments would result in:

- 1) establishment of site-specific, numeric temperature objectives for Deer Creek;
- 2) improved definition of the seasonal nature of Deer Creek's warm and cold freshwater habitat beneficial uses; and
- 3) establishment of a surveillance and monitoring program, which makes maximal use of existing programs, to evaluate compliance with the revised objectives and their protection of beneficial uses.

As part of the SSBPA process, site-specific technical information has been compiled for Deer Creek temperature, both above and below the DCWWTP, which characterizes existing conditions. In addition, a compilation of the temperature requirements of freshwater aquatic life, with an emphasis on the aquatic organisms known to occur in Deer Creek, is provided. This information is presented in the appendices of this Staff Report.

1.2 PURPOSE AND INTENDED USE OF THIS STAFF REPORT

The purpose of this Staff Report is to define and provide support for the proposed Basin Plan amendment, presented herein, and to provide the rationale behind each part of the amendment. **Section 1** (Introduction) provides historical and regulatory background for the Basin Plan amendment process, defines the purpose and need for the proposed site-specific amendment, and provides a brief background on Deer Creek. **Section 2** (Summary of Proposed Amendment to the Basin Plan) presents the proposed site-specific, numeric water quality objectives for Deer Creek temperature. **Section 3** (Beneficial Uses) discusses Deer Creek's beneficial uses. **Section 4** (Water Quality Objectives) discusses the rationale for the proposed site-specific, numeric temperature objectives. **Section 5** (Antidegradation Analysis) evaluates the proposed site-specific objectives with respect to the federal and state antidegradation policies. **Section 6** (Endangered Species Act Consultations) summarizes the results from technical discussions held with National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) regarding the proposed amendment. **Section 7** (Programs for Implementation of Site-Specific Objectives) discusses the need for and rationale behind the program for implementation of the site-specific objectives and the time schedule for compliance. **Section 8** (Surveillance and Monitoring) describes water quality and biological monitoring that will occur, should the proposed amendment be adopted, to assess both compliance and level of beneficial use protection. Finally, **Section 9** includes the analysis of environmental impacts associated with the proposed action (i.e., proposed amendment) and three alternatives to the proposed action.

This report will be circulated for public review and comment and the proposed SSBPAs will be the subject of a public hearing before the Regional Board. After the public hearing is closed, the Regional Board may adopt the amendment as proposed, make modifications to the proposed amendment (major modifications would require a new public hearing) and adopt, or not adopt the proposed amendment. The public hearing will be noticed according to standard Regional Board protocols. Interested parties are encouraged to comment on the proposed Basin Plan amendment and Staff Report.

Regional Board staff will provide written responses to comments received. To assist staff in identifying and responding to comments, please submit written comments in the format suggested in **Appendix B**. If you have any questions concerning the proposed amendment, please contact Mr. Rik Rasmussen at (916) 255-3103.

Following adoption by the Regional Board, the proposed Basin Plan amendment will not become effective until reviewed and approved by the State Board, OAL, and U.S. EPA. The entire review and approval process (from the time Regional Board staff present the proposed amendments to their Board until approved by U.S. EPA) is estimated to be completed by June 2003.

2 SUMMARY OF PROPOSED AMENDMENT TO THE BASIN PLAN

This section of the Staff Report presents the amendment language as it is proposed to appear in the Basin Plan, and provides a statement defining the intent of the new language added to the Basin Plan via this amendment. Specifically, the amendment proposed in this Staff Report consists of site-specific, numeric temperature objectives for Deer Creek.

2.1 INTRODUCTION (BASIN PLAN CHAPTER 1)

No modifications to Chapter I (Introduction) of the Basin Plan are proposed.

2.2 EXISTING AND POTENTIAL BENEFICIAL USES (BASIN PLAN CHAPTER II)

No modifications to Chapter II (Existing and Potential Beneficial Uses) of the Basin Plan are proposed.

2.3 WATER QUALITY OBJECTIVES (BASIN PLAN CHAPTER III)

The proposed modifications to water quality objectives consist of site-specific, numeric water quality objectives for Deer Creek temperature. The specific proposed additions to Section III, p. 8 (temperature) are highlighted and italicized (*highlighted*).

The new numeric, Basin Plan objectives for Deer Creek temperature are intended to accomplish two things. First, the daily maximum objectives, for each of the defined periods of the year, are intended to protect Deer Creek's aquatic life (the beneficial use of the creek most sensitive to water temperature) against thermal impacts that could result from acute (i.e., short-term) exposure to elevated water temperatures. Second, the mean monthly objectives are intended to protect Deer Creek's aquatic life against thermal impacts that could result from chronic (i.e., long-term) exposure to elevated water temperatures.

No deletions are proposed to this section of the Basin Plan. A detailed discussion of the rationale and technical information in support of the proposed site-specific objectives is provided in Section 4 of this report, and in appendices of this Staff Report.

The following text constitutes **specific pages of the Basin Plan**, with the proposed amendments *highlighted*.

NOTE THAT ONLY THOSE PORTIONS OF THE BASIN PLAN WITH CHANGES ARE PROVIDED WITH SURROUNDING TEXT TO PROVIDE CONTEXT FOR THE CHANGE. ROWS OF ASTERISKS (****) INDICATE WHERE SECTIONS OF TEXT HAVE NOT BEEN INCLUDED.

III. WATER QUALITY OBJECTIVES

The Porter-Cologne Water Quality Control Act defines water quality objectives as "...the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area" [Water Code Section 13050(h)]. It also requires the Regional Water Board to establish water quality objectives, while acknowledging that it is possible for water quality to be changed to some degree without unreasonably affecting beneficial uses. In establishing water quality objectives, the Regional Water Board must consider, among other things, the following factors:

- Past, present, and probable future beneficial uses;
- Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;
- Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;
- Economic considerations;
- The need for developing housing within the region;
- The need to develop and use recycled water. (Water Code Section 13241)

The Federal Clean Water Act requires a state to submit for approval of the Administrator of the U.S. Environmental Protection Agency (*USEPA*) all new or revised water quality standards which are established for surface and ocean waters. As noted earlier, California water quality standards consist of both beneficial uses (identified in Chapter II) and the water quality objectives based on those uses.

There are **seven important points** that apply to water quality objectives.

The **first point** is that water quality objectives can be revised through the basin plan amendment process. Objectives may apply region-wide or be specific to individual water bodies or parts of water bodies. Site-specific objectives may be developed whenever the Regional Water Board believes they are

appropriate. As indicated previously, federal regulations call for each state to review its water quality standards at least every three years. These Triennial Reviews provide one opportunity to evaluate changing water quality objectives, because they begin with an identification of potential and actual water quality problems, i.e., beneficial use impairments. Since impairments may be associated with water quality objectives being exceeded, the Regional Water Board uses the results of the Triennial Review to implement actions to assess, remedy, monitor, or otherwise address the impairments, as appropriate, in order to achieve objectives and protect beneficial uses. If a problem is found to occur because, for example, a water quality objective is too weak to protect beneficial uses, the Basin Plan should be amended to make the objective more stringent. (Better enforcement of the water quality objectives or adoption of certain policies or redirection of staff and resources may also be proper responses to water quality problems. See the Implementation chapter for further discussion.)

Changes to the objectives can also occur because of new scientific information on the effects of water contaminants. A major source of information is the USEPA which develops data on the effects of chemical and other constituent concentrations on particular aquatic species and human health. Other information sources for data on protection of beneficial uses include the National Academy of Science which has published data on bioaccumulation and the Federal Food and Drug Administration which has issued criteria for unacceptable levels of chemicals in fish and shellfish used for human consumption. The Regional Water Board may make use of those and other state or federal agency information sources in assessing the need for new water quality objectives.

The **second point** is that achievement of the objectives depends on applying them to controllable water quality factors. *Controllable water quality factors* are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State, that are subject to the authority of the State Water Board or the Regional Water Board, and that may be reasonably controlled. Controllable factors are not allowed to cause further degradation of water quality in instances where uncontrollable factors have

* * * * *

Temperature

The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses.

Temperature objectives for COLD interstate waters, WARM interstate waters, and Enclosed Bays and Estuaries are as specified in the *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California* including any revisions. There are also temperature objectives for the Delta in the State

Water Board's May 1991 *Water Quality Control Plan for Salinity*.

At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature.

Temperature changes due to controllable factors shall be limited for the water bodies specified as described in Table III-4. To the extent of any conflict with the above, the more stringent objective applies. *For Deer Creek, source to Cosumnes River, temperature changes due to discharges shall not cause creek temperatures to exceed the objectives stipulated in Table III-4A.*

In determining compliance with the water quality objectives for temperature, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.

TABLE III-4
SPECIFIC TEMPERATURE OBJECTIVES

DATES

From 1 December to 15 March, the maximum temperature shall be 55°F.

From 16 March to 15 April, the maximum temperature shall be 60°F.

From 16 April to 15 May, the maximum temperature shall be 65°F.

From 16 May to 15 October, the maximum temperature shall be 70°F.

From 16 October to 15 November, the maximum temperature shall be 65°F.

From 16 November to 30 November, the maximum temperature shall be 60°F.

The temperature in the epilimnion shall be less than or equal to 75°F or mean daily ambient air temperature, whichever is greater.

The temperature shall not be elevated above 56°F in the reach from Keswick Dam to Hamilton City nor above 68°F in the reach from Hamilton City to the I Street Bridge during periods when temperature increases will be detrimental to the fishery.

APPLICABLE WATER BODY

Sacramento River from its source to Box Canyon Reservoir (9); Sacramento River from Box Canyon Dam to Shasta Lake (11)

Lake Siskiyou (10)

Sacramento River from Shasta Dam to I Street Bridge (13, 30)

TABLE III-4A
SPECIFIC TEMPERATURE OBJECTIVES FOR DEER CREEK

<i>Date</i>	<i>Daily Maximum (°F)^a</i>	<i>Monthly Average (°F)^b</i>
<i>January and February</i>	63	58
<i>March</i>	65	60
<i>April</i>	71	64
<i>May</i>	77	68
<i>June</i>	81	74
<i>July through September</i>	81	77
<i>October</i>	77	72
<i>November</i>	73	65
<i>December</i>	65	58

a Maximum not to be exceeded.

b Defined as a calendar month average.

Toxicity

All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity

tests of appropriate duration or other methods as specified by the Regional Water Board.

The Regional Water Board will also consider all material and relevant information submitted by the discharger and other interested parties and numerical criteria and guidelines for toxic substances developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, the U.S. Food and Drug Administration, the National Academy of Sciences, the U.S. Environmental Protection Agency, and other appropriate

* * * * *

2.4 IMPLEMENTATION (BASIN PLAN CHAPTER IV)

No modifications to Chapter IV (Implementation) of the Basin Plan are proposed.

2.5 SURVEILLANCE AND MONITORING (BASIN PLAN CHAPTER V)

Insert the following paragraph at the end of the "Special Studies" section on page V-2.00:

Another such study is a surveillance and monitoring program conducted by the El Dorado Irrigation District (EID) on Deer Creek in El Dorado and Sacramento Counties. Regional Board staff will work with EID to ensure adequate temperature, flow and

biological monitoring is conducted to evaluate compliance with the site specific temperature objectives for Deer Creek and their effect on beneficial uses.

3 BENEFICIAL USES

This section of the Staff Report provides a brief overview of federal and state regulations pertaining to beneficial use designation as part of establishing water quality standards. This section also discusses Deer Creek's past, present, and probable future beneficial uses.

3.1 FEDERAL AND STATE REGULATORY OVERVIEW

Section 303 of the CWA requires that states protect beneficial uses of waters of the United States within their jurisdictional boundaries. U.S. EPA regulations interpret that requirement further to require that states adopt water quality *criteria* (referred to as "*objectives*" in California) that protect the designated "beneficial uses" of water bodies. The designated beneficial uses and associated quality criteria, along with the anti-degradation policy, constitute water quality standards.

States adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the CWA. "Serve the purposes of the Act" (as defined in Sections 101(a)(2) and 303(c) of the Act) means that water quality standards should, at a minimum:

- provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water ("fishable/swimmable"); and
- consider the use and value of State waters for public water supplies, propagation of fish and wildlife, recreation, agriculture, and industrial purposes, and navigation (USEPA 1994, p. 2-1).

In designating beneficial uses for a water body, states are required to consider, at a minimum, those uses listed in Sections 101(a)(2) and 303(c) of the CWA, specified above. However, states are allowed to develop subcategories of uses, within the Act's general categories, to "... *refine and clarify specific use classes.*" For example, subcategories of aquatic life uses may be on the basis of attainable habitat (e.g., coldwater versus warmwater habitat) (USEPA 1994, p. 2-5). The U.S. EPA also notes: "*In some areas of the country, uses are practical only for limited seasons. EPA recognizes seasonal uses in the Water Quality Standards Regulation. States may specify the seasonal uses and criteria protective of that use as well as the time frame for the '...season', so long as the criteria do not prevent the attainment of any more restrictive uses attainable in other seasons*" (USEPA 1994, p. 2-6).

The CWA requires states to protect "existing uses." Existing uses are defined as those beneficial uses actually attained in the water body on or after November 28, 1975 (40 CFR Section 131.3(e)).

Beneficial use designation is discussed prior to water quality objectives in this report because water quality objectives are dependent upon the beneficial use designation. Beneficial use categories established for water bodies within the Sacramento River and San Joaquin River basins are listed and defined in the Fourth Edition of the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins – Central Valley Region (Basin Plan) (RWQCB 1998). Uses that may be protected include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves (Water Code Section 13050(f)).

In designating beneficial uses, the Water Code (Section 13241) requires the Regional Board to consider, among other things, the past, present, and probable future beneficial uses of water, environmental characteristics of the hydrographic unit under consideration, including the quality of water thereto, economics, and the water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.

3.2 BENEFICIAL USES OF DEER CREEK

3.2.1 Existing Beneficial Uses

The Basin Plan (RWQCB 1998) states:

“The beneficial uses of any specifically identified water body generally apply to its tributary streams...”

Deer Creek is tributary to the Cosumnes River, a “named” water body in the Basin Plan, and the Regional Board have assigned, via the “tributary rule,” its beneficial uses to Deer Creek. The beneficial uses of the Cosumnes River are: municipal and domestic supply (MUN), irrigation and stock watering (AGR), recreation (REC-1 and REC-2), freshwater habitat (WARM and COLD), migration (WARM and COLD), spawning (WARM and COLD), and wildlife habitat (WILD).

The Basin Plan provides the following definitions for “WARM” and “COLD” freshwater aquatic habitats (RWQCB 1998, p. II-2).

“Warm Freshwater Habitat (WARM): Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD): Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.”

All other water quality parameters being adequate for freshwater aquatic life, seasonal temperature regimes can affect aquatic systems at multiple levels of biological organization. For this reason, temperature in aquatic systems must be effectively regulated. Effective temperature regulation can only be achieved with a clear understanding of site-specific factors, which ultimately must be reflected in regulatory limits developed for a given water body. Because the freshwater habitat, migration, and spawning WARM/COLD beneficial uses are the beneficial uses most affected by water temperature, additional characterization of the WARM/COLD uses that are specific to Deer Creek is warranted and is, therefore, provided below.

3.2.1.1 Aquatic Life Uses

Through a combination of direct and indirect effects on individual organisms, water temperature is the primary factor dictating whether “warmwater” or “coldwater” aquatic communities dominate within a water body. For optimal physiological activity and health, coldwater species of fish and macroinvertebrates not only require the colder water temperatures that characterize coldwater aquatic habitat, but also the higher dissolved oxygen concentrations that typically occur in coldwater relative to warmwater systems. Similarly, warmwater aquatic organisms not only have higher thermal tolerances than coldwater organisms, they generally can maintain important activities at lower dissolved oxygen concentrations, relative to most coldwater organisms.

Deer Creek’s headwaters originate just north of Cameron Park Lake. Its source water flows into Cameron Park Lake, which overflows a low-head dam on the downstream end of the lake. This lake overflow provides much of Deer Creek’s source water during the non-precipitation period of the year. Other sources include urban runoff and tributary inflows. During the winter and spring months of the year, precipitation-related runoff constitutes the majority of source water to the creek. The source waters of Deer Creek, along with its elevation (most of the creek is near or below 1,000 ft. (msl)), physical channel morphology, flow rates, exposure to solar radiation, and ambient air temperatures work together to create the creek’s seasonal temperature regime upstream and downstream of the DCWWTP.

Multiple fish and macroinvertebrate surveys have been conducted to further characterize the freshwater habitat uses of Deer Creek (**Figure 2**). The fish surveys were conducted in August 1993 (JSA 1993), July and September 1994 (CDFG 1994), with a brief CDFG “follow-up survey” in 1995, September and October 1996 (SWRI 1996), and September 1999 (Nature Conservancy/U.C. Davis 1999). The macroinvertebrate surveys were conducted in April 1998 (CDFG 1998) and October 2000 (BAS 2001).

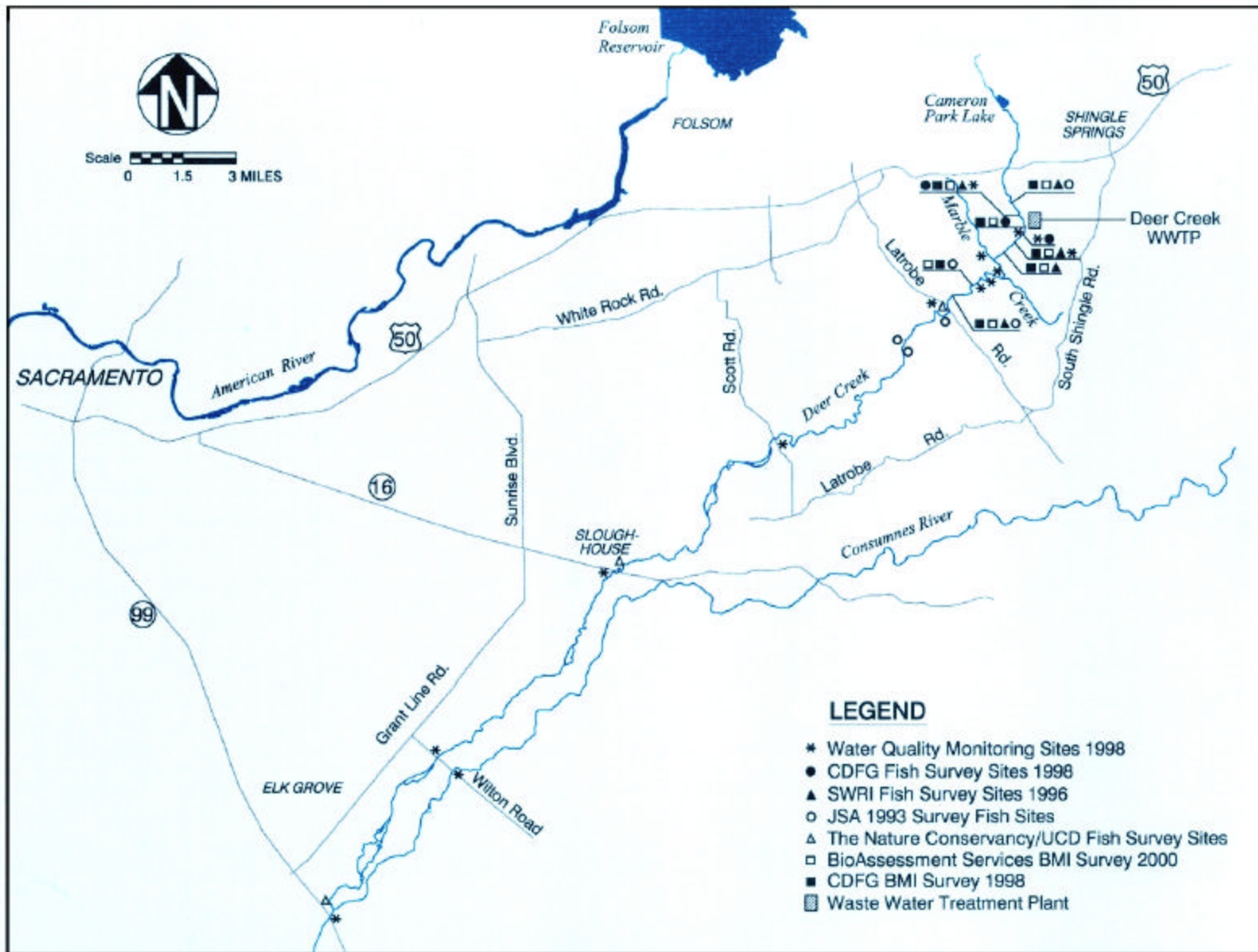


Figure 2. Location of fish and benthic macroinvertebrate survey sites and water quality monitoring sites in Deer Creek, El Dorado and Sacramento Counties, California.

3.2.1.1.1 Fish Communities

The results of the fish surveys are summarized in **Table 1**. Results of the CDFG 1995 “follow-up survey” were not quantified in a report and, therefore, were not included in the summary provided below. Nevertheless, findings from CDFG’s 1995 survey were consistent with the findings reported in Table 1 (S. Lehr, CDFG Fishery Biologist, pers. comm., April 24, 2000). The past fish surveys show that all fish species documented upstream of the DCWWTP also occur downstream of the plant (Table 1). Based on the results of these surveys, Deer Creek supports a greater number of fish species downstream of the DCWWTP than upstream. As shown by the fish community data presented in Table 1, bluegill are common above and below the DCWWTP.

Table 1. **Summary results from Deer Creek fish surveys, El Dorado and Sacramento Counties, California.**

Fish Species	Upstream of DCWWTP		Downstream of DCWWTP	
	Survey Documenting Presence	Relative Abundance ^b	Survey Documenting Presence	Relative Abundance ^b
Bluegill	CDFG (1994) SWRI (1996) Conservancy (1999)	abundant abundant common	JSA (1993) CDFG (1994) SWRI (1996) Conservancy (1999)	abundant a abundant common
California roach	JSA (1993) CDFG (1994) SWRI (1996) Conservancy (1999)	abundant abundant abundant abundant	CDFG (1994)	a
Green sunfish	CDFG (1994) SWRI (1996)	a common	JSA (1993) SWRI (1996) Conservancy (1999)	uncommon common common
Hardhead			SWRI (1996)	abundant
Mosquitofish	SWRI (1996)	common	JSA (1993) SWRI (1996)	common abundant
Prickly sculpin			JSA (1993) SWRI (1996) Conservancy (1999)	common common common
Rainbow trout	CDFG (1994)	a	CDFG (1994)	a
Sacramento pikeminnow			JSA (1993) CDFG (1994) SWRI (1996) Conservancy (1999)	abundant a abundant abundant
Sacramento sucker			JSA (1993) SWRI (1996) Conservancy (1999)	abundant abundant common
Lower Deer Creek Near Confluence with Cosumnes River (Conservancy 1999 survey only)				
Black bullhead				uncommon
Golden shiner				common
Lamprey				uncommon
Largemouth bass				uncommon
Logperch				uncommon
Smallmouth bass				common

^a Sampling was not conducted in a manner conducive to estimating relative abundance.

^b The terms “abundant”, “common”, and “uncommon” refer to the frequency with which the species were captured during surveys: Abundant = frequently captured; common = commonly captures; and uncommon = infrequently captured.

The abundance of other introduced species (i.e., green sunfish and mosquitofish) also is similar upstream and downstream of the DCWWTP. The surveys conducted have collectively shown California roach to be abundant upstream, but much less abundant downstream. California roach are perhaps the most temperature tolerant fish found in the creek, with a reported upper temperature limit of 97-100°F (36-38°C) (Cech et al. 1985). Hence, seasonal differences in water temperature upstream and downstream of the DCWWTP would not cause this difference in California roach abundance above and below the plant site. The reason for their lower abundance downstream is that they are a primary prey species of the Sacramento pikeminnow, hardhead, and green sunfish. The primary predatory species, pikeminnow, has not been found upstream of the DCWWTP. This is likely due to their inability to pass the natural barrier (i.e., cascade) located at the plant site. The substantially reduced predation pressure upstream probably accounts for higher abundance of California roach in this reach of the creek.

Four fish species native to California – hardhead, prickly sculpin, Sacramento pikeminnow, and Sacramento sucker – have been documented to occur only downstream of the DCWWTP. Hardhead, Sacramento sucker, and Sacramento pikeminnow are very abundant downstream, with the abundance of prickly sculpin being lower than the other three species. The low-flow habitats that occur upstream of the DCWWTP, coupled with the large cascade near the plant site which blocks all upstream fish migration, are the primary reasons why these fish species do not occur upstream of the DCWWTP.

In 1994, CDFG staff collected (via electroshocking surveys) one rainbow trout downstream of the DCWWTP on July 1, and two rainbow trout upstream of the DCWWTP on September 6. The three adult rainbow trout that were captured in Deer Creek by CDFG Fishery Biologist S. Lehr in his 1994 fish survey are believed to have originated from a landowner's stocking of rainbow trout into a small, unnamed spring-fed creek that flows through the landowner's property and into Deer Creek, just upstream of the limestone quarry that exists approximately one-half mile upstream of the DCWWTP (S. Lehr and M. Mainz, CDFG, pers. comm., November 5, 2002). These three trout are not believed to have been individuals from a natural, self-sustaining population of rainbow trout supported by Deer Creek.

Fish surveys conducted (both upstream and downstream of the DCWWTP) in 1993 (JSA), 1995 (CDFG), 1996 (SWRI), and 1999 (Cosumnes River Nature Conservancy/U.C. Davis) did not find any trout, either upstream or downstream of the DCWWTP. However, the other fish species found during the 1994 CDFG survey were consistent with those found in the JSA (1993), CDFG (1995), SWRI (1996), and Nature Conservancy/U.C. Davis (1999) surveys.

Finally, the sampling near the confluence with the Cosumnes River by the Cosumnes River Nature Conservancy/U.C. Davis in 1999 documented that six additional fish species make use of Deer Creek in this lower reach. None of these six species were found by the Conservancy/U.C. Davis investigators at or upstream of Latrobe Road, nor were any of these six species documented to occur at or upstream of Latrobe Road by

any of the other fish surveys conducted by JSA (1993), CDFG (1994, 95), or SWRI (1996).

The Nature Conservancy/U.C. Davis, which conducted the 1999 lower reach fish survey cited above, also conducted Deer Creek fish surveys in 2000, 2001, and 2002. Results from these surveys were not available when the initial draft of this Staff Report was prepared and, therefore, are presented here as part of subsequent revisions to this report.

Deer Creek at Country Club Rd. (Near Highway 50) – several miles upstream of the DCWWTP:

8/9/00- 21 California roach; 2 bluegill; 5 largemouth bass

7/26/02-10 California roach; 8 bluegill; 25 green sunfish

Deer Creek at Latrobe Rd – approximately 4 miles downstream of the DCWWTP:

8/9/00- 30 Sacramento pikeminnow; 3 green sunfish; 9 Sacramento sucker

8/28/01- 164 S. pikeminnow; 15 green sunfish; 2 S. suckers; 1 prickly sculpin; 1 mosquitofish

7/2/02- Approx. 50 S. pikeminnow; approx. 10 mosquitofish; 2 prickly sculpin

Deer creek at the confluence with the Cosumnes River – about 35 miles downstream of the DCWWTP:

8/22/00- 14 S. pikeminnow; 1 prickly sculpin

7/5/01- 1 largemouth bass; note: almost no water, just a few minor pools.

Approx. 6/15/02- dry; no water

Cosumnes River just below confluence with Deer Creek:

8/22/00- 82 largemouth bass; 35 suckers; 5 redeye bass; 8 bluegill; 36 pikeminnow

7/5/01- 4 spotted bass; 5 pikeminnow

Approx 6/15/02- dry; no water

These additional Deer Creek fish surveys, conducted by The Nature Conservancy/U.C. Davis during the period 2000-2002, bring the total number of fish surveys conducted on Deer Creek between 1993 and 2002 to eight (8) including four (4) lower reach surveys. The 2000-2002 surveys documented the same fish species in Deer Creek identified in the Draft Staff Report, found no rainbow trout at any site (either above or below the DCWWTP), and did not document any new species for the creek that would require modification of the propose temperature objectives.

Based on available fish data discussed above, current effluent discharges from the DCWWTP do not cause the number of fish species present, or their respective relative abundances to be lesser downstream compared to upstream of the DCWWTP. The same can be said for the benthic macroinvertebrate communities present upstream and downstream of the DCWWTP.

3.2.1.1.2 Benthic Macroinvertebrate Communities

Benthic macroinvertebrates (BMI's) are useful indicators of site-specific water quality conditions because they are ubiquitous in aquatic systems, have limited mobility, have short and complex life cycles, and vary in their tolerances to water quality (Barbour et al. 1999). Because benthic macroinvertebrates exploit different niches in the aquatic environment and have distinctly different pollution tolerances, their communities at a given site provide insight into habitat quality, including water quality.

The BMI communities of Deer Creek upstream and downstream of DCWWTP, and within the effluent channel, were characterized following the completion of major DCWWTP upgrades in March 1997. The first post-plant-upgrade survey was conducted by the CDFG in April 1998, with a second survey conducted by BioAssessment Services in October 2000 (BAS 2001). In these investigations, sites were chosen for sampling within seven distinct riffle habitats – two upstream of the DCWWTP (U1 and U2), one in an undiluted “effluent channel” (EFF), and four downstream of the DCWWTP (D1-D4) (**Figure 3**). The two sites sampled upstream of the DCWWTP were located in Deer Creek’s “main channel” approximately 80m upstream of the access road to the DCWWTP (U1) and approximately 50m upstream of the confluence of Deer Creek and the effluent channel (U2).

Deer Creek’s channel is braided at the DCWWTP site, meaning it flows through three distinct channels under winter/early spring high-flow conditions. The rest of the year, it only flows through the main channel, which is located between the other two channels at the DCWWTP site. Both CDFG (1998) and BAS (2001) sampled the effluent channel (EFF) in addition to Deer Creek’s main channel above (U1 and U2) and below (D1-D4) the DCWWTP. The effluent channel is the channel of Deer Creek that passes closest to the DCWWTP and, therefore, is the channel into which effluent is initially discharged from the DCWWTP. During the winter and early spring months (e.g., December through April/May), some creek water typically flows into this channel, and thus there is some level of dilution upon effluent entering this channel. Conversely, for the period of about May through November, annually, creek water does not flow into the effluent channel upstream of the discharge point; rather, the creek’s complete flow during these months is restricted to the main channel. Consequently, the benthic macroinvertebrate community residing within the effluent channel is isolated from the rest of the creek, and sustained by undiluted effluent throughout this May through November period. The riffle sampled at the EFF site was located within about 100 meters of the point of effluent discharge to this channel. This information is important to note when interpreting the BMI survey findings.

Finally, four riffles were sampled downstream of the DCWWTP. Site D1 was located approximately 800m downstream of the confluence of the effluent channel and main channel. Site D2 was located about another 800m downstream of the D1 site. Site D3 was located approximately 900m downstream of D2, and site D4 was located approximately 100m upstream of the Latrobe Road bridge (Figure 3).

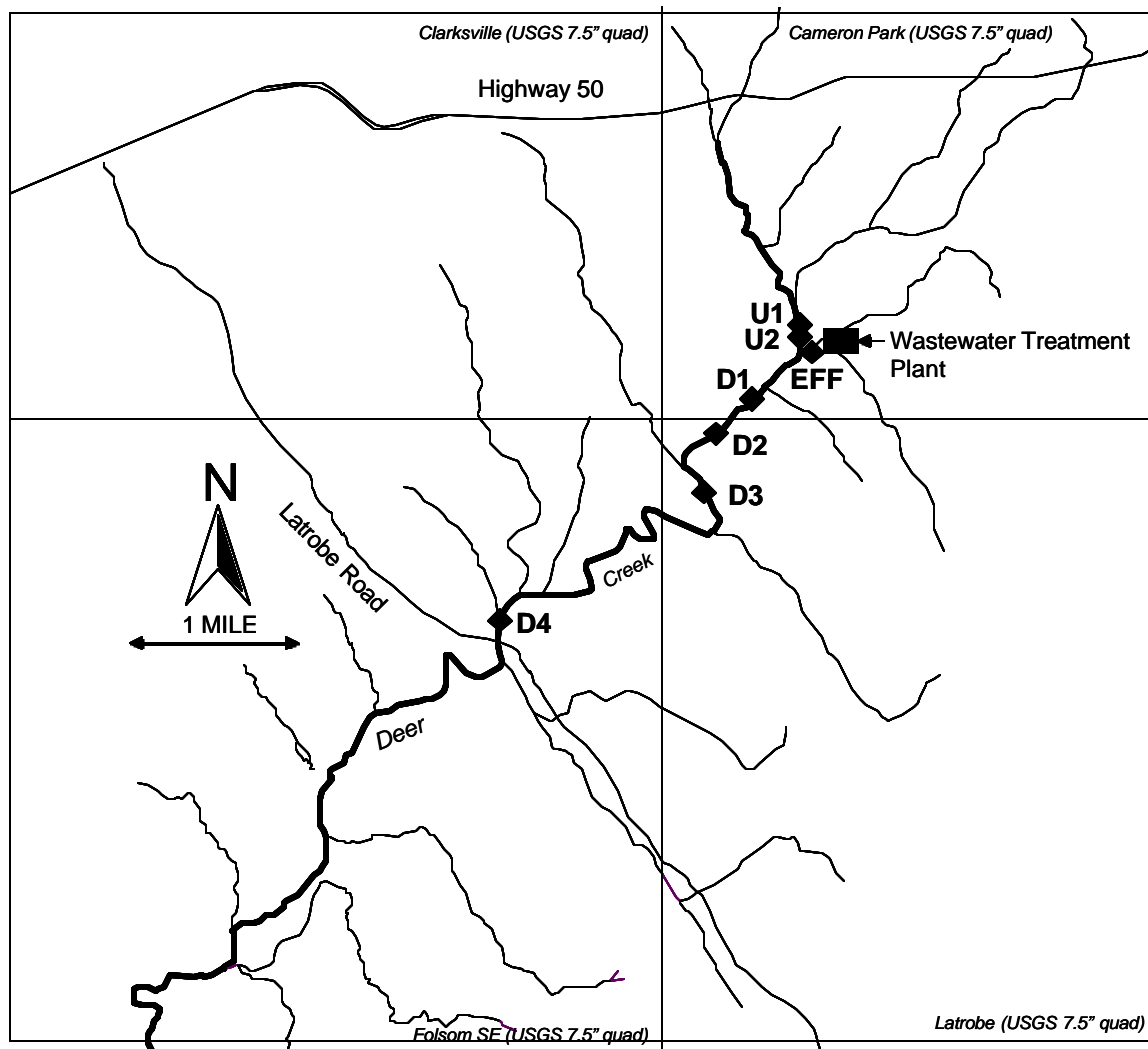


Figure 3. Deer Creek study area and benthic macroinvertebrate sampling sites for CDFG (1998) and BAS (2001), El Dorado and Sacramento Counties, California.

Both the CDFG (1998) and BAS (2001) surveys were performed using the California Stream Bioassessment Procedures (CSBP) for point source assessments (Harrington 1996). The samples were analyzed using a series of metrics, which assign numeric values based on particular attributes of the BMI community. The mean BMI metric values from the CDFG (1998) and BAS (2001) surveys are summarized in **Table 2**. When using these metrics to evaluate overall water quality, metric values for Taxonomic Richness, EPT Taxa richness, EPT Index, and Shannon Diversity are all expected to decrease with water quality impairment. Conversely, metric values for Percent Dominant Taxon and Tolerance Value are expected to increase with water quality impairment.

Table 2. Sampling site mean values and coefficients of variation (CV) of metric values and total taxonomic richness for benthic macroinvertebrate assemblages in Deer Creek, El Dorado County, California. Data presented are from surveys conducted by CDFG (1998) in April 1998 and BAS (2001) in October 2000.

<i>Sites:</i>		U1		U2		EFF		D1		D2		D3		D4	
Metric		Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Taxonomic Richness	CDFG	16	0.22	16	0.26	12	0.34	17	0.06	16	0.11	15	0.12	14	0.08
	BAS	19	0.15	16	0.25	11	0.22	19	0.09	18	0.06	18	0.06	20	0.12
EPT Taxa	CDFG	3	0.22	2	0.35	2	0.25	2	0.25	2	0.00	2	0.25	2	0.25
	BAS	4	0.00	4	0.00	1	0.00	5	0.25	5	0.12	5	0.25	4	0.00
EPT Index	CDFG	37	0.60	30	0.15	36	0.33	64	0.12	60	0.12	64	0.04	55	0.02
	BAS	14	0.55	18	1.15	1	0.87	45	0.49	39	0.33	28	0.84	16	0.34
Percent Dominant Taxon	CDFG	54	0.15	41	0.13	44	0.14	61	0.12	56	0.11	60	0.04	51	0.03
	BAS	65	0.34	69	0.44	53	0.16	43	0.21	44	0.31	57	0.49	50	0.26
Tolerance Value	CDFG	5.1	0.08	5.2	0.16	5.7	0.14	5.6	0.05	5.6	0.04	5.2	0.06	5.2	0.06
	BAS	6.4	0.06	6.4	0.10	6.4	0.06	6.1	0.07	5.9	0.04	6.1	0.08	6.0	0.06
Shannon Diversity	CDFG	1.5	0.07	1.7	0.07	1.4	0.08	1.4	0.13	1.5	0.09	1.4	0.04	1.6	0.03
	BAS	1.5	0.50	1.2	0.71	1.3	0.16	1.8	0.03	1.8	0.10	1.5	0.33	1.9	0.16
		Total		Total		Total		Total		Total		Total		Total	
Taxonomic Richness	CDFG	24		25		22		25		24		22		23	
	BAS	28		22		15		27		27		29		25	
EPT Taxa	CDFG	4		2		3		3		2		3		3	
	BAS	4		4		2		7		5		6		5	

The results for Taxonomic Richness, EPT Taxa richness, Percent Dominant Taxon, and Shannon Diversity were similar between the two surveys. More importantly, these metrics indicate no downstream or temporal trends of water quality impairment. Scores for EPT Index were consistently higher across all sites for the April CDFG (1998) survey compared to the October BAS (2001) survey suggesting a seasonal effect for this metric. The metric scores for Tolerance Value were consistently higher across all sites for the BAS (2001) survey compared to the CDFG (1998) survey, also suggesting a seasonal effect on community structure. The EPT Index scores reported for both surveys were considerably higher at the downstream sites compared to upstream sites. Overall, the results of these surveys suggest no downstream trends of water quality impairment resulting from the DCWWTP effluent (Table 2).

The overall heterogeneity in functional feeding group proportions of the Deer Creek BMI community is indicative of a diverse, healthy ecosystem condition at the upstream and downstream sites (**Figure 4**). The results of both surveys indicate a fully functioning community with predators, grazers, filterers, and collectors present at all sites. The fact that shredders were absent at all sites in the BAS (2001) survey and comprised, on average, only 1% of the functional feeding groups in the CDFG (1998) survey (Figure 4) is likely due to the CDFG's CSBP sampling only riffle habitats. Shredders are dependent on terrestrially derived organic material (i.e., leaves and twigs) as their primary food source and are, therefore, typically found in highest abundance in depositional habitats (i.e., pools) where leaves and woody material settle out and accumulate, and are far less abundant in riffle habitats. Because the CSBP methodology requires that only riffles be sampled, the proportion of shredders is probably under-represented for creeks and streams as a whole. Finally, the BAS (2001) survey found an elevated proportion of collectors in the effluent channel, which was attributed to seasonality of sampling.

To assess potential impacts of the effluent on the benthic macroinvertebrate community, a Morisita-Horn (1966) Index of Similarity value was calculated for all pair-wise comparisons of sites from the CDFG (1998) survey and the BAS (2001) survey (**Table 3**). This value indicates the degree of overlap in the BMI community structure by relative abundance of each taxa present and is calculated as follows:

$$\text{Morisita's } C = \frac{2 \sum p_{ij} p_{ik}}{p_{ij}^2 + p_{ik}^2}$$

“where C is the index of similarity, p_{ij} and p_{ik} are the relative abundance of the i^{th} species in the j^{th} and k^{th} site respectively.”

Values may range from 0 to 1, where 0 indicates no similarity between the communities and 1 indicates perfect similarity between the communities. Low degrees of similarity between upstream and downstream sites would be expected if the effluent water quality was having a negative effect on the stream biota. Conversely, high degrees of similarity suggest that no chronic, negative water quality related impacts to the biota are occurring.

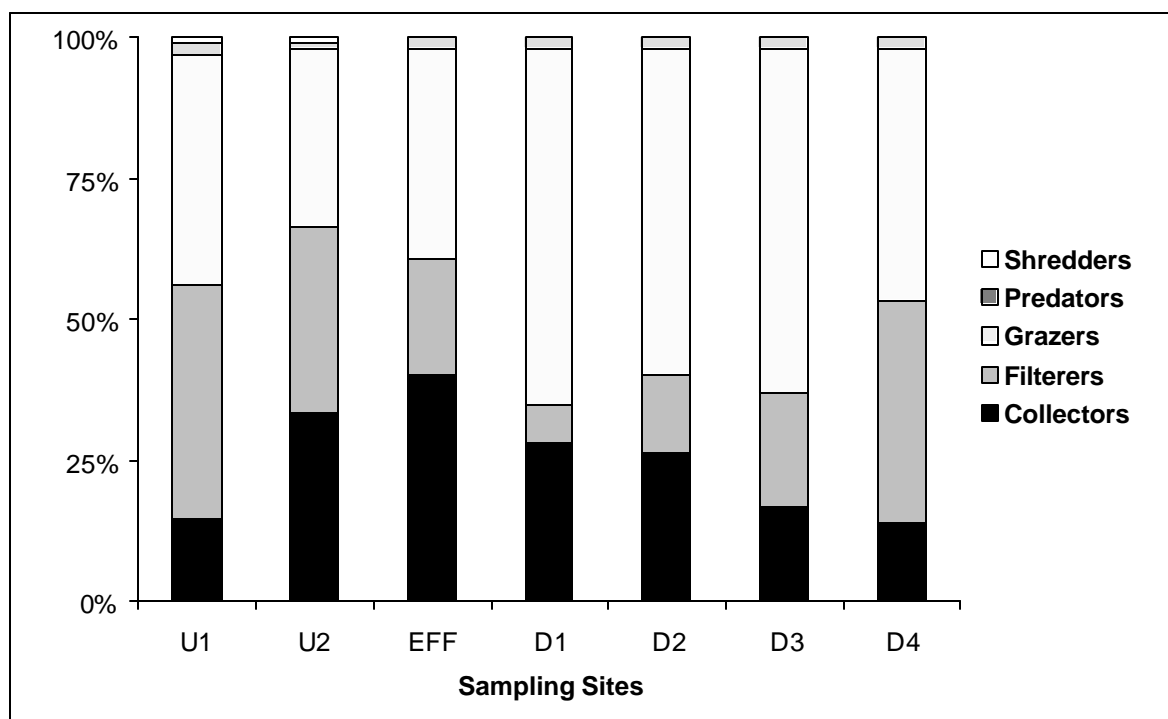
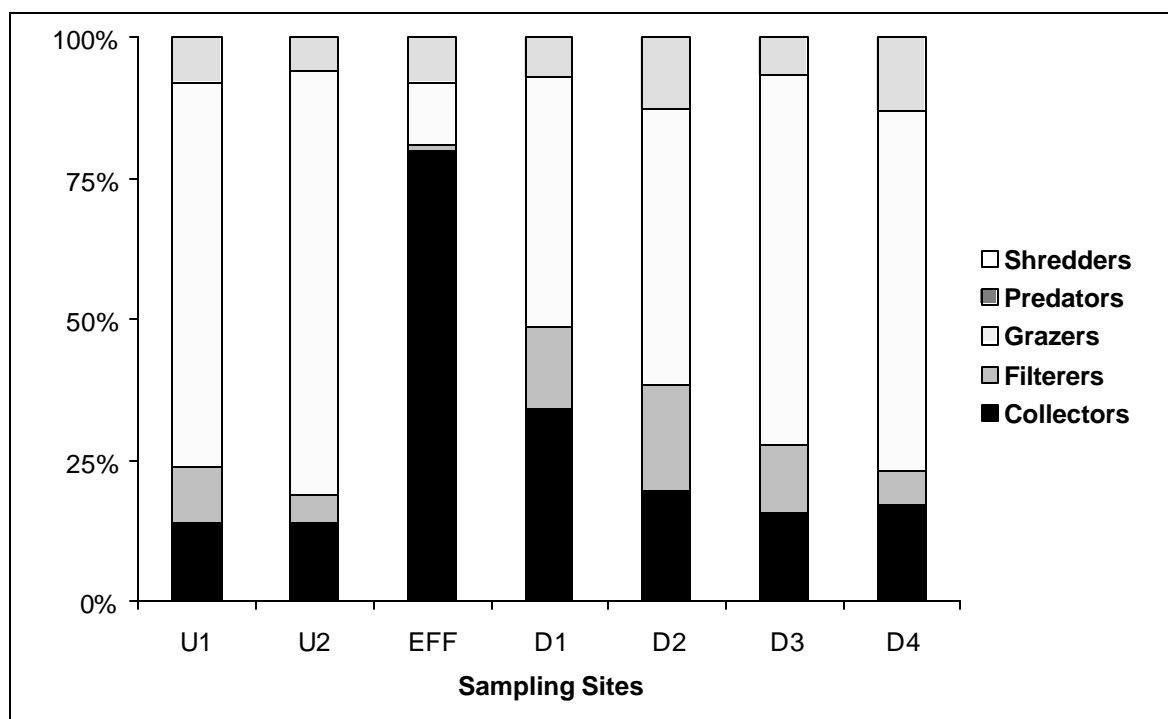
A**B**

Figure 4. **Deer Creek benthic macroinvertebrate functional feeding group proportions, by site, based on data collected from the April CDFG (1998) (A) and October BAS (2001) (B) surveys, El Dorado County, California.**

Table 3. **Morisita-Horn (Horn 1966) similarity index values for all pair-wise comparisons of Deer Creek sites from benthic macroinvertebrate sampling by CDFG (1998) (A) and BAS (2001) (B), El Dorado County, California. Similarity value of 0 indicates no similarity between sites, whereas a value of 1 indicates complete similarity between sites.**

A

	U1	U2	EFF	D1	D2	D3	D4
U1	--	0.94	0.86	0.74	0.79	0.85	0.92
U2		--	0.90	0.67	0.71	0.76	0.84
EFF			--	0.84	0.87	0.85	0.88
D1				--	0.99	0.99	0.93
D2					--	0.98	0.95
D3						--	0.98
D4							--

B

	U1	U2	EFF	D1	D2	D3	D4
U1	--	0.99	0.01	0.80	0.88	0.98	0.96
U2		--	0.01	0.79	0.86	0.97	0.94
EFF			--	0.40	0.02	0.02	0.06
D1				--	0.96	0.89	0.87
D2					--	0.95	0.93
D3						--	0.97
D4							--

Similarities were high (0.94, 0.99) between the upstream sites in both surveys (Table 3). Comparisons of upstream sites to downstream sites also showed relatively high Similarity, ranging from 0.67 to 0.92 (mean = 0.79) for the CDFG (1998) survey and from 0.79 to 0.98 (mean = 0.90) for the BAS (2001) survey (Table 3).

Interestingly, the degree of similarity between the BMI communities in the effluent channel and the upstream and downstream sites were relatively high (range = 0.84 to 0.90) for the CDFG (1998) survey, yet were relatively low (range = 0.01 to 0.40) for the BAS (2001) survey (Table 3). The BAS (2001) survey attributed this effect to the fact that this survey was conducted in October, when flows in the creek were low, effluent contributed the only flow for the 5-6 month period preceding the October sampling, and re-colonization due to BMI drift had not occurred during this period of time.

No temperature effects of the effluent discharge could be identified based on differences in BMI community structured species composition. Upon review of survey findings, the CDFG (1998) investigators reported the following:

“The BMI [benthic macroinvertebrate] metrics and similarity index analyses both indicated that the WWTP effluent did not have a large effect on the biotic condition of Deer Creek downstream of the effluent discharge. Even the biotic condition of the effluent channel seemed to be satisfactory when compared to the other sites. The high proportion of the semi-tolerant grazing mayfly, Baetis sp., downstream of the WWTP probably indicated some enrichment in the lower sections of the study area, but cattle grazing in the downstream areas undoubtedly contribute to any downstream enrichment.”

This latter statement, regarding the significance of cattle grazing as a primary source of nutrient enrichment in Deer Creek, is further supported by the fact that *Baetis* sp. was the most dominant taxa at site U1, and the second most dominant taxa at site U2, the two sites surveyed upstream of the DCWWTP. Cattle are grazed both upstream and downstream of the DCWWTP.

In summary, the findings from the fish and BMI surveys provide important insight into how Deer Creek's water quality is affecting its aquatic resources. Although some differences were observed in communities above and below the DCWWTP, the differences observed were not indicative of degraded water quality below the plant, and specifically cannot be attributed to differences in temperature regimes above and below the DCWWTP (**Appendix C and D**). In fact, diverse, healthy, and fully functional fish and benthic macroinvertebrate communities were documented at sites surveyed both above and below the DCWWTP. Any water quality related effects that the DCWWTP discharge is having on the biotic condition of Deer Creek downstream of the plant is negligible.

3.2.1.1.3 Warm vs. Cold Aquatic Habitat

The resident, self-sustaining communities of fish and benthic macroinvertebrates using Deer Creek are comprised of warmwater species. To date, no resident, self-sustaining populations of coldwater fish or benthic macroinvertebrates have been documented to occur in Deer Creek in the vicinity of the DCWWTP. Adult rainbow trout were found during the 1994 fish survey but have not been documented in subsequent surveys. The potential for opportunistic use of Deer Creek by anadromous salmonids (i.e., fall-run chinook salmon and steelhead), which are coldwater species, exists during a portion (i.e., winter and spring) of certain years, should hydrologic and water temperature conditions in Deer Creek be conducive to such use. The nature of these aquatic life uses of Deer Creek are discussed below.

3.2.1.1.3.1 WARM

Five fish and two BMI surveys conducted on Deer Creek between 1993 and 2000 were used to characterize Deer Creek's existing aquatic ecology. The SWRI (1996) study provides a third BMI survey, in addition to the CDFG (1998) and BAS (2001) surveys summarized above. The SWRI (1996) survey was not included in the detailed BMI discussions above because it was conducted prior to the completion of significant plant upgrades.

The two BMI surveys and five fish surveys performed all or, at a minimum, a portion of their sampling in the vicinity of the DCWWTP. The results from these surveys have demonstrated that the creek's current resident aquatic communities, both upstream and downstream of the DCWWTP, are comprised of healthy, self-sustaining populations of warmwater fish and macroinvertebrates. Fish populations were determined to be healthy based on the presence of multiple age classes, adult sizes consistent with expected sizes for fish in a water body with Deer Creek's characteristics, and a low incidence of observable external lesions and parasites.

The fish assemblage present in Deer Creek downstream of the DCWWTP, which is dominated by native species, is typical of fish assemblages documented for Sierra foothill streams (USGS 2000). Based on its survey of 22 sites throughout the Sacramento River Basin between 1996 and 1998, including nine foothill sites, and its multivariate statistical analyses of survey findings, the U.S. Geological Survey (USGS) (2000) defined six fish community metrics to relate fish community structure to environmental quality. The six metrics defined included: 1) percentage of native fish; 2) number of native species; 3) percentage of intolerant fish [intolerant to environmental degradation]; 4) number of tolerant species; 5) percentage of omnivorous fish; and 6) percentage of fish with anomalies. Using fish survey data collected for Deer Creek at sites located within the first four miles downstream of the DCWWTP (summarized above), each of the six metrics defined by USGS (2000) were calculated for Deer Creek, downstream of the DCWWTP, and compared to the range of metric values reported by USGS (2000) for the nine foothill sites USGS surveyed. With the exception of percentage of native fish, all metrics calculated for Deer Creek, downstream of the

DCWWTP, fell within the range reported for the nine foothill sites surveyed by USGS (2000). The percentage of native fish metric calculated for Deer Creek (63%) was somewhat lower than the range (87-100%) reported by USGS (2000). This indicates that Deer Creek has a relatively high percentage of introduced fish species compared to the foothill sites surveyed by USGS (2000).

Based on these findings, as well as those reported by Moyle and Nichols (1973), Moyle (1976), and Cech et al. (1990) (see Appendix D), it can be concluded that the fish assemblage present in Deer Creek, downstream of the DCWWTP, is typical of Sierra foothill streams.

3.2.1.1.3.2 COLD

Results from the five fish surveys and two benthic macroinvertebrate surveys conducted on Deer Creek between 1993 and 2000 demonstrate that no resident, self-sustaining populations of coldwater fish or benthic macroinvertebrates currently occur in Deer Creek. The BMI surveys (CDFG 1994 and SWRI 1996) conducted prior to the 1996-97 DCWWTP upgrades produced this same basic finding. No use of Deer Creek by anadromous salmonids has been documented by scientific surveys or anecdotal observations by creek-side residents or others. Also, with the exception of the occurrence of lamprey sp. documented in Deer Creek near its confluence with the Cosumnes River by the Nature Conservancy/U.C. Davis investigators in 1999, no non-salmonid anadromous fish species (e.g., striped bass, sturgeon, or American shad) have, to date, been documented in Deer Creek.

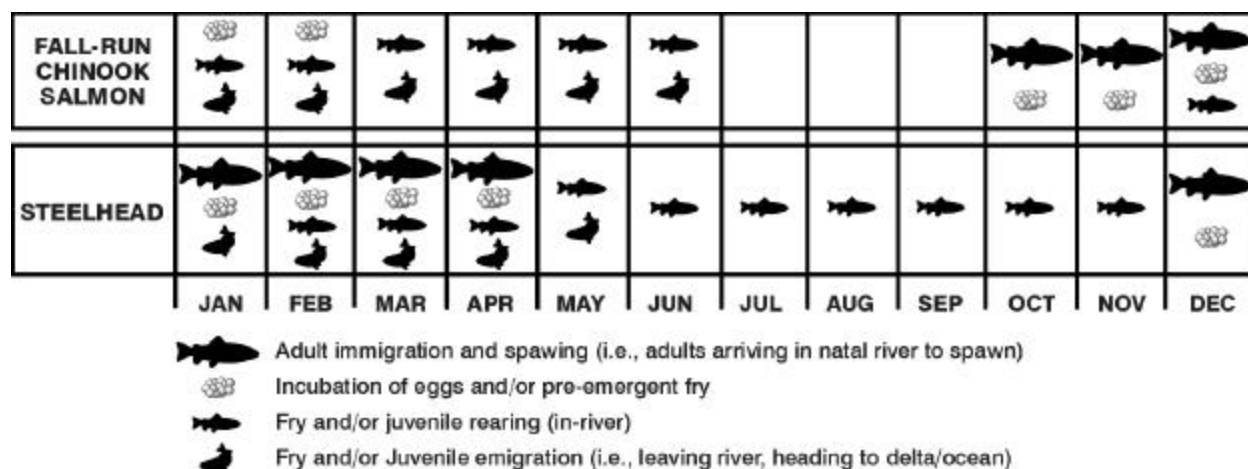
Fishery biologists B. Reavis (former CDFG District Fishery Biologist responsible for the Cosumnes River and Deer Creek, pers. comm., July 13, 1999) and K. Whitener (Project Ecologist, The Nature Conservancy, pers. comm., April 24 and October 20, 2000) – both of whom have studied the anadromous fish resources of the Cosumnes River – indicated that the Cosumnes River currently supports a small run of fall-run chinook salmon (up to about 600 fish), but does not support any other runs of chinook salmon or steelhead. Discussions held with R. Titus (CDFG Fishery Biologist, pers. comm., July 13, 1999), B. Snider (CDFG Fishery Biologist, pers. comm., July 15, 1999), and K. Hill (CDFG Fishery Biologist, pers. comm., July 21, 1999) confirmed this characterization of anadromous fish use of the Cosumnes River. The Cosumnes River does not support an annual run of steelhead largely due to a natural barrier that prevents steelhead from accessing the upper reaches of the river where year-round temperatures and other conditions would be suitable to supporting a run (K. Whitener, The Nature Conservancy, Project Ecologist, pers. comm., April 24 and October 20, 2000)

Regional Board staff and fishery biologists from CDFG, NMFS, and The Nature Conservancy agree that a potential may exist for anadromous salmonids using the Cosumnes River to make opportunistic use of Deer Creek during a portion of certain years. It is the potential for seasonal, opportunistic use of Deer Creek by anadromous salmonids (i.e., fall-run chinook salmon and potentially steelhead that stray into the

Cosumnes river system) that represents the COLD freshwater habitat, migration, and spawning beneficial uses assigned, via the “tributary rule,” to Deer Creek.

The potential “window of opportunity” for opportunistic use of Deer Creek by fall-run chinook salmon and steelhead would be highly variable from year to year, and may not occur at all during years when creek flow and temperature conditions are not conducive to such use at the appropriate times of the year.

For the purposes of general context, a generalized life cycle for Central Valley fall-run chinook salmon and steelhead is provided below. Additional discussions follow which more specifically define the timing for potential opportunistic use of Deer Creek by fall-run chinook salmon and steelhead, and how the various life stages of these fish species would behave under the creek’s current hydrologic and water temperature regimes.



Fall-run Chinook Salmon

December through April is the typical period of the year when there is a potential for opportunistic use of Deer Creek by fall-run chinook salmon. The factors determining this period are discussed further below.

The primary adult immigration and spawning period for fall-run chinook salmon occurs October through December. Recent investigations on the Cosumnes River have shown that the river’s hydrology limits the ability of adult fall-run chinook salmon to immigrate through the lower reaches of the river to upstream spawning grounds (located upstream of the confluence with Deer Creek). Currently, the flow in the lower reach of the Cosumnes River (i.e., downstream of its confluence with Deer Creek, near Hwy 99, to its confluence with the Mokelumne River), is intermittent during the summer and much of the fall period (B. Reavis, CDFG Fishery Biologist pers. comm., July 13, 1999; K. Hill, CDFG Fishery Biologist, pers. comm., July 21, 1999; K. Whitener, The Nature Conservancy, Project Ecologist, pers. comm., June 5, 2000). Low-flow conditions currently hinder the ability of fall-run chinook salmon to immigrate to upstream spawning

grounds in the Cosumnes River until significant precipitation events occur, which increase river flow rates (Whitener 1998).

Although influenced by Cosumnes River hydrologic and water temperature conditions, the potential for opportunistic use of Deer Creek during the fall period is primarily dependent upon hydrologic and water temperature conditions within Deer Creek itself. During the summer period, Deer Creek is perennial for about 10 miles or so downstream of the DCWWTP discharge, below which it becomes an intermittent creek for much of the remaining 20-25 miles to its confluence with the Cosumnes River. Creek flows may be sub-surface in the vicinity of Scott Road and elsewhere during the summer months (**Figure 5**), but no documentation regarding subterranean flows exists. Surface flow continuity must be restored before fall-run chinook salmon could immigrate from the Cosumnes River, through approximately 20 miles of Deer Creek, to reach suitable spawning habitat, which primarily occurs upstream of Scott Road (S. Lehr, CDFG Fishery Biologist, pers. comm., June 5 and October 20, 2000).

In addition to having sufficient creek flows to facilitate adult passage, salmon would need suitable water temperatures before spawning would be initiated in the creek. Fall-run chinook salmon spawning studies conducted on the lower American River by CDFG biologists have shown that fall-run chinook salmon initiate spawning activity when water temperatures decline to an average of about 60°F or lower (e.g., CDFG 1996). Spawning is typically delayed in water bodies until the 60°F threshold is achieved. This results in variable timing of initial spawning among water bodies within each year (based on their individual thermal regimes), and within a given water body from year to year.

Suitable conditions for opportunistic use of Deer Creek by fall-run chinook salmon in recent years has not occurred until early December. Fall-run chinook salmon typically could not opportunistically utilize Deer Creek during October or November because the current hydrology in Deer Creek does not allow them passage to suitable spawning habitat during these months (S. Lehr, CDFG Fishery Biologist, pers comm., October 20, 2000). In the event that early, heavy rains occur during the fall, resulting in hydrology sufficient for passage to suitable spawning habitat within Deer Creek during late October or November, water temperatures also would be conducive to opportunistic use under such conditions (S. Lehr, CDFG Fishery Biologist; K. Whitener, The Nature Conservancy, Project Ecologist, pers. comms., October 20, 2000). Moreover, Deer Creek data collected under four high-flow conditions resulting in surface flow continuity with the Cosumnes River, show that discharges from the DCWWTP have negligible effects on downstream creek temperatures under such high-flow conditions (**Figure 6**). Thus, DCWWTP discharges would not preclude or adversely affect the potential for opportunistic use of the creek in years when early high flows occur.

Based on their life history strategy, the majority of young fall-run chinook salmon produced in a water body emigrate from the system as post-emergent fry during the winter and early spring months, shortly after emerging from the gravel. Should the



Figure 5. **Photograph of Deer Creek's channel at Scott Road on July 11, 2000.**

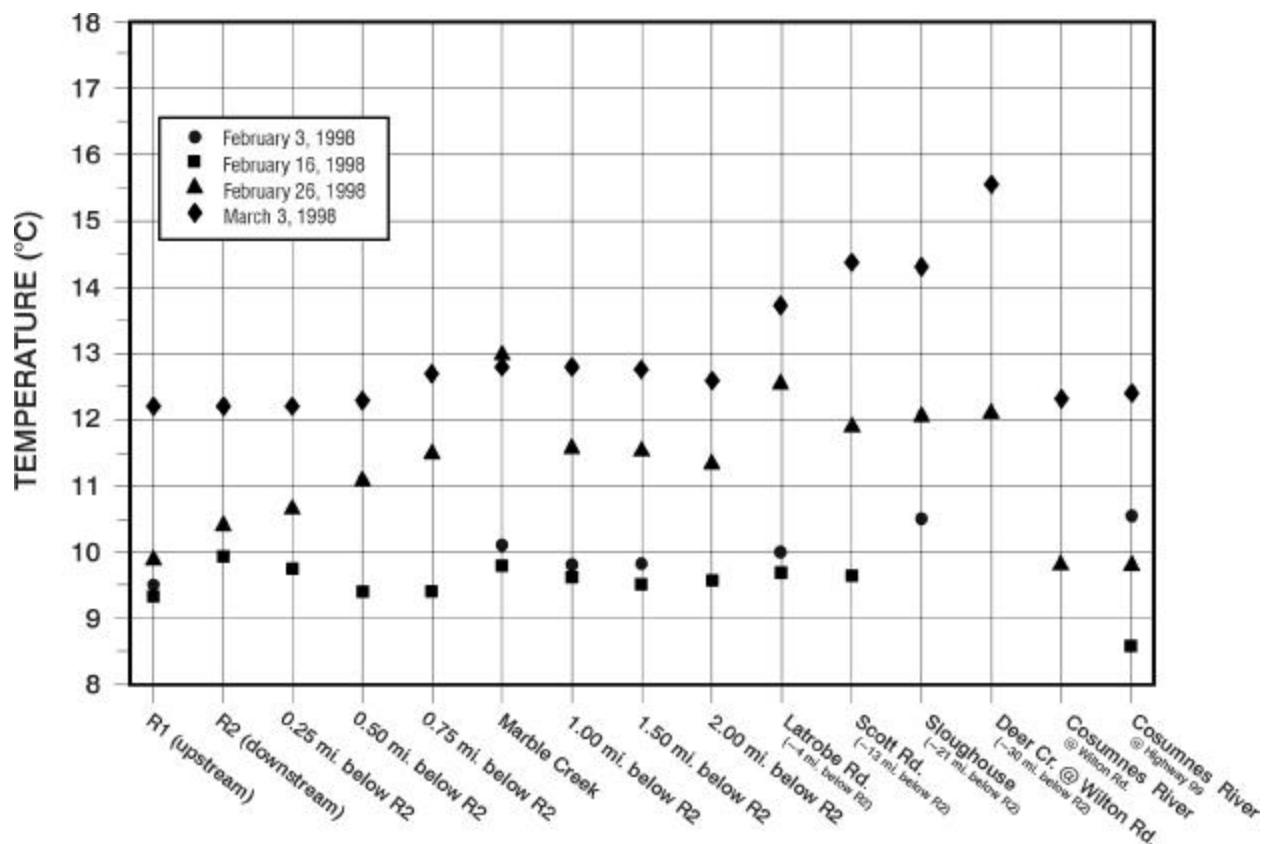


Figure 6. Water temperatures measured at various locations in Deer Creek, in Marble Creek just above its confluence with Deer Creek, and at two locations in the Cosumnes River during the period February 3, 1998 through March 3, 1998.

water body maintain average water temperatures below the mid to upper 60s (°F), some portion of young fall-run chinook salmon may remain in their natal stream for several months before emigrating during the late spring/early summer months as larger juveniles or smolts. Elevated water temperatures result in emigration from the system (CDFG 1992, 1993; B. Snider, CDFG Sr. Fishery Biologist, Native Anadromous Fish and Watershed Branch, pers. comm., November 7, 2000).

Average water temperatures in Deer Creek (both upstream and downstream of the DCWWTP) typically reach and begin exceeding 60°F in late March/early April, and were shown to reach and even exceed an average temperature of 70°F during May 2000 and 2001 (Appendix C, Figures C-3 and C-4). Based on their knowledge of fall-run chinook salmon life history strategies and the annual hydrologic and water temperature regimes of Deer Creek and the Cosumnes River, fishery biologists S. Lehr (CDFG) and K. Whitener (The Nature Conservancy) concurred that young fall-run chinook salmon potentially produced in Deer Creek would be expected to emigrate from the system during April, and possibly as late as May in wetter, cooler years (pers. comm., October 20, 2000).

Steelhead

Because the Cosumnes River does not currently support an annual run (of any size) of steelhead, it is unlikely that steelhead would make opportunistic use of Deer Creek (B. Reavis, CDFG Fishery Biologist, pers. comm., July 13, 1999; R. Titus, CDFG Fishery Biologist, pers. comm., July 13, 1999; B. Snider, CDFG Fishery Biologist, pers. comm., July 15, 1999; K. Hill, CDFG Fishery Biologist, pers. comm., July 21, 1999; and K. Whitener, The Nature Conservancy, Project Ecologist, pers. comm., April 24 and October 20, 2000). Available historic data and accounts indicate that just one adult and one juvenile steelhead have been observed by biologists in the Cosumnes River (S. Lehr, CDFG Fishery Biologist, and K. Whitener, pers. comms., April 24, 2000).

December through May is the typical period of the year when there may be a potential for opportunistic use of Deer Creek by steelhead. The potential for opportunistic use during this period is dependent upon annual hydrologic and water temperature conditions in both Deer Creek and the Cosumnes River. Consequently, the period of the year when the potential for opportunistic use may occur will vary from year to year.

December through March is the primary spawning period for Central Valley steelhead. Instream flows in both the Cosumnes River and Deer Creek, sufficient to facilitate upstream passage of spawning adults from the Delta to suitable spawning habitat within Deer Creek, typically occur in December. This coincides temporally with the onset of steelhead adult immigration.

Young steelhead normally rear in their natal stream for one to several years before emigrating to the ocean. However, this general life history strategy is rather "elastic," and juvenile steelhead can modify their freshwater residence period and timing of emigration in response to in-stream conditions. This is particularly relevant when discussing the potential for steelhead to make opportunistic use of water bodies like Deer Creek and the Cosumnes River that do not, in any year, provide suitable over-summer rearing conditions for juvenile steelhead.

Steelhead would not readily survive the summer temperatures that occur in Deer Creek, which regularly exceed 75°F (23.9°C) on a daily average basis, and reach daily highs of 79-82°F (26.1-27.8°C) (Appendix C, Figures C-1 through C-4). Creeks with low summer flows, such as Deer Creek, gain heat as they flow from the foothill region down into the valley floor.

At a project team technical meeting held on June 5, 2000, D. Smith, a NMFS fishery biologist, indicated that juvenile steelhead begin moving in search of colder water when average water temperatures in their natal stream reach approximately 68°F. Failure to find improved conditions and/or further increases in average water temperatures result in emigration from the system (D. Smith, NMFS Fishery Biologist, pers. comm., June 5, 2000). Based on available data, average Deer Creek water temperatures reach and begin to exceed 68°F (both upstream and downstream of the DCWWTP) during May (Appendix C, Figures C-3 and C-4).

Based on his knowledge of steelhead life history strategies and the annual hydrologic and water temperature regimes of Deer Creek and the Cosumnes River, S. Lehr, Fishery Biologist with CDFG indicated that young steelhead potentially produced in Deer Creek would be expected to emigrate from the system during April, and possibly during May in wetter years (pers comm., October 20, 2000).

Hydrology

Available site-specific hydrologic data and observations indicate that Deer Creek typically loses surface flow continuity (i.e., reaches of creek such as the reach in the vicinity of Scott Road lose all above-ground flow, with possibly only subsurface flows occurring) in late spring/early summer (Appendix G). Any successful emigration of anadromous fish would have to occur before surface flow continuity is lost. The flow augmentation that results from DCWWTP effluent discharges would generally increase the period of surface flow continuity in the spring/early summer, thereby reducing the risk that surface flow continuity would be lost prior to water temperature reaching levels that would result in young anadromous fish emigration from the system. Effluent discharges from the DCWWTP would not contribute to “trapping” anadromous salmonids that may be opportunistically produced in Deer Creek; rather, discharges would contribute to preventing such occurrences. For additional discussion on the Deer Creek watershed and Deer Creek’s hydrology, see Section 4.7.2.2.

3.2.2 Past Beneficial Uses

Based on available information and best professional judgment, the beneficial uses of Deer Creek are not believed to have changed since the DCWWTP began discharging effluent to the creek. Rather, only subtle differences in the “degree” to which various uses are supported are believed to have changed.

The DCWWTP began discharging treated municipal effluent to the creek in 1974. No detailed documentation of the beneficial uses (including the presence of warm and cold water aquatic species) or the physical, chemical, or biological characteristics of Deer Creek is available for any time prior to 1974. For example, the Environmental Impact Statement prepared for the Deer Creek Basin Water Reclamation Project of the El Dorado Irrigation District (EID 1972) did not provide information on specific fish species or aquatic ecosystems present in Deer Creek. Rather, it briefly stated that Deer Creek is an intermittent stream depending on natural runoff from the surrounding low-elevation foothills for its source water. It further stated that the intermittent, seasonal instream flow throughout much of the creek’s length limits the wildlife and aquatic life uses that the creek supports. Consequently, past beneficial uses are inferred based on best professional judgment regarding the hydrology and water quality of Deer Creek prior to 1974.

The Deer Creek watershed has been significantly altered due to urban development, ranching, and other human activities, relative to natural, pre-settlement conditions.

Deer Creek hydrology and water temperatures in the 1960s, and early 1970s were already impacted by human activities, and have continued to be impacted by such human activities in recent decades.

The past hydrology of Deer Creek, during the precipitation period of the year (e.g., late fall, winter and spring), probably differed little from the hydrology of Deer Creek today. This is because precipitation-related runoff constitutes the primary source of water to the creek during these periods of the year. During the non-precipitation period of the year, effluent discharges constitute the primary source of water in the creek downstream of the DCWWTP, annually (SWRCB 1995). Upstream of the DCWWTP, urban runoff, and seepage from Cameron Park Dam, currently produces base flows that are higher than what occurred in this reach of the creek prior to 1974. As such, creek flows both upstream and downstream of the DCWWTP would have been lower (substantially lower downstream) during much of the summer/fall period, prior to 1974.

The lower summer/fall flow rates that occurred prior to 1974 would have resulted in a lesser amount of wetted habitat (CDFG 1994b; SWRCB 1995; S. Lehr, CDFG Fishery Biologist, pers. comm., November 8, 2000). Consequently, the “degree” to which the creek supported resident, self-sustaining aquatic and wildlife communities, riparian communities, recreation, and water supply, particularly downstream of the DCWWTP, may have been somewhat reduced. It is unlikely that an annual run of either fall-run chinook salmon or steelhead would have occurred in Deer Creek based on the creek’s precipitation-driven hydrograph prior to 1974, (S. Lehr, CDFG Fishery Biologist, pers. comm., November 8, 2000). However, these species may have made opportunistic use of the creek during a portion of the winter/spring periods of some years. The potential that existed prior to 1974 for opportunistic use of Deer Creek by fall-run chinook salmon and steelhead is believed to be similar to that which exists today. The hydrologic effects of effluent discharges from the DCWWTP have not reduced or eliminated the potential for opportunistic use by fall-run chinook salmon or steelhead, and may actually have increased the probability of successful emigration in the event that such use were to occur (S. Lehr, CDFG Fishery Biologist, pers. comm., November 8, 2000).

Pre-1974 water quality, upstream of the DCWWTP, likely would have been somewhat better than that which occurs today. Development of the upper watershed since 1974 has likely caused some degradation in Deer Creek water quality. The difference between current upstream water quality (including water temperature) and that which occurred prior to 1974 is not believed to be sufficient to have changed the beneficial uses supported upstream of the DCWWTP.

The same can be said for downstream of the DCWWTP. The additional factor influencing downstream water quality today, relative to the pre-1974 condition, is effluent discharges. The discharge of treated effluent to Deer Creek does not reduce or adversely affect downstream water quality in ways that would fail to maintain and protect the creek’s beneficial uses (SWRCB 1995; SWRI 1996). Of the downstream water quality parameters affected by effluent discharges, creek temperature is of

particular importance with regards to its potential effects on aquatic life uses and, therefore, is discussed further below.

The relative magnitude of temperature increase in the creek due to effluent discharges from the DCWWTP is highly variable, depending on month of year, and even time of day. The average magnitude of temperature increase for a given month also is quite variable from year to year, based on variation in creek flow rates, ambient air temperatures, and other factors. Available temperature data for Deer Creek in the vicinity of the DCWWTP (Appendix C) show that the upper end of the range of temperatures that occur in the creek is similar upstream and downstream of the DCWWTP during the January through September period of the year. During the October through December period, the temperatures downstream of the DCWWTP discharge are elevated relative to temperatures upstream of the DCWWTP. Finally, available data show that DCWWTP discharges sometimes reduce peak daily temperatures, compared to upstream of the plant, when upstream temperatures reach approximately 78-82°F (25.6-27.8°C) (Appendix C, Figures C-1 and C-2).

Integration of available biological data collected for Deer Creek in the vicinity of the DCWWTP between 1993 and 2000 (see Section 3.2.1.1) with available creek temperature data (Appendix C) indicate that the timing, magnitude and frequency of discharge-related changes in Deer Creek water temperatures downstream of the DCWWTP have not caused the fish species composition, or the relative abundance of individual fish species present, to be demonstrably lesser downstream, relative to upstream. In other words, the thermal loading from the plant has not limited either fish species composition or relative abundance downstream of the point of discharge when assessed relative to upstream assemblages (see discussion under Section 3.2.1.1.1). The same can be said for the benthic macroinvertebrate communities present upstream and downstream of the DCWWTP (see Section 3.2.1.1.2).

The above finding, coupled with the current documented diversity and condition of downstream fish and benthic macroinvertebrate communities, support the conclusion that the effects of effluent discharges on the seasonal temperature regime of Deer Creek, downstream of the DCWWTP, have not been sufficiently large to have eliminated or prevented the continued maintenance of any species of aquatic organism that was supported by the creek prior to effluent discharges (S. Lehr, CDFG Fishery Biologist, pers. comm., November 8, 2000).

In short, the fish and macroinvertebrate populations and communities documented to be sustaining themselves in Deer Creek today, both upstream and downstream of the DCWWTP, are believed to be essentially equivalent populations and communities to those that existed prior to 1974 (S. Lehr, CDFG Fishery Biologist, pers. comm., November 8, 2000). Differences that may exist regarding the creek's past and existing aquatic communities are believed to be primarily related to population sizes (as a function of creek size or hydrology) and not species composition or community diversity or function.

3.2.3 Probable Future Beneficial Uses

Available data, and best professional judgment, indicate that the probable future beneficial uses of Deer Creek would be the same as the existing beneficial uses currently assigned to the creek (see Section 3.2.1), assuming no significant changes to upstream hydrology or watershed activities that directly impact the creek.

Two actions that could occur in the future that, in the event of their full implementation, could affect Deer Creek's future beneficial uses include: 1) buildout of the DCWWTP, potentially to 10.8 mgd; and 2) restoration of lower Cosumnes River summer/fall hydrology downstream of the Hwy 99 Bridge. The potential effects of each on Deer Creek's probable future beneficial uses are discussed below.

3.2.3.1 Buildout of the DCWWTP (10.8 mgd)

The District's Environmental Impact Report (EIR) titled: *Deer Creek Wastewater Treatment Plant Expansion Project, Draft EIR* (ESA 1998), included a project description that defined the future capacity of the DCWWTP, at buildout (e.g., 2030), to potentially be 10.8 mgd. This buildout condition was discussed and evaluated in the EIR at a programmatic level (rather than project level) because there is a high level of uncertainty surrounding the numerous factors that will ultimately determine the capacity of the DCWWTP at buildout. A capacity of 10.8 mgd was selected for programmatic assessment because it represented a "worst-case" scenario for environmental assessment purposes. Since the above-cited EIR was published, the District has updated its Wastewater Master Plan (HDR 2001). The capacity of the DCWWTP at 2030 is not likely to reach 10.8 mgd. For example, the District's current Wastewater Master Plan projects an ADWF in 2025 of approximately 3.6 mgd (HDR 2001). Nevertheless, the 10.8 mgd buildout scenario is maintained in this Staff Report because: 1) it provides a highly conservative worst-case scenario; and 2) quantitative evaluations of the 10.8 mgd buildout scenario were completed in support of this Staff Report prior to the District's revision of the buildout capacity through its updated Wastewater Master Plan. Operation of the DCWWTP at a higher capacity would increase the rates of effluent discharge to the creek throughout the year.

3.2.3.1.1 Non-precipitation Period

Under current conditions, the creek's upstream base flow has been documented to be as low as approximately 0.3 mgd during the summer/fall period (Dewante and Stowell 1993; RWQCB 1999). Current discharges can result in downstream flows being nearly 90% effluent, on the average, and greater than 90% effluent on an instantaneous basis. As such, a number of the existing beneficial uses currently assigned to Deer Creek (e.g., freshwater habitat (WARM/COLD), agriculture (AGR), and recreation (REC-1, REC-2)) are, in large part, maintained during the non-precipitation period of the year by effluent discharges from the DCWWTP. The discharge of larger volumes of effluent in the future would have minimal effects on the degree to which downstream flows are dominated by treated effluent during the non-precipitation period and, therefore, would have minimal effects on downstream water quality parameters, relative to existing

conditions. Therefore, the higher future rate of effluent discharge would be expected to support the same beneficial uses, during the non-precipitation period of the year, that are supported today.

Best available information indicates that even a 10.8 mgd ADWF discharge would not be of sufficient magnitude to maintain surface flow continuity throughout the year (SWRCB 1995; SWRI 1996). Rather, the higher rate of discharge would be expected to extend the period of surface flow continuity later into the spring/early summer, relative to what occurs currently, and would extend the length of perennially wetted channel downstream of the DCWWTP. The length of time that surface flow continuity would be extended is unknown, and would vary annually based on factors such as antecedent rainfall conditions and soil saturation. This finding further supports the conclusion that Deer Creek, under the future DCWWTP buildout condition, would be expected to support the same beneficial uses, during the non-precipitation period of the year, that it currently supports.

3.2.3.1.2 Precipitation Period

During the precipitation period of the year, effluent discharges constitute a highly variable fraction of downstream flows. Creek base flows change by three orders of magnitude due to the timing, magnitude and duration of storm events. Dilution ratios vary greatly during the precipitation period of the year. This condition would continue in the future because it is caused primarily by the creek's precipitation-driven hydrology. The range of water quality currently experienced within the creek during the precipitation period of the year would be expected to continue in the future.

Increased flow rates of Deer Creek at its confluence with the Cosumnes River that would occur during this period of the year, at buildout conditions, would have the potential to cause greater attraction of Cosumnes River fall-run chinook salmon into Deer Creek. However, this is dependent on the success of future planned actions to augment (i.e., restore) Cosumnes River flows during the fall-run chinook salmon spawning period (see discussion below). The net effect of increasing both Deer Creek and Cosumnes River flow, in terms of attracting fall-run chinook salmon into Deer Creek, remains uncertain.

Future increases in DCWWTP effluent discharges are not expected to eliminate or modify the beneficial uses currently maintained by the creek during the precipitation period of the year. Rather, best available information suggest that future beneficial uses of Deer Creek during the precipitation period of the year would be the same as those that exist today.

3.2.3.2 Cosumnes River Anadromous Salmonid Restoration Actions

CALFED, The Nature Conservancy, USFWS, and others are working cooperatively to improve conditions in the Cosumnes River for anadromous salmonids, primarily fall-run chinook salmon. Specifically, attention is being given to restoring the summer/fall

hydrology in the lower reaches of the Cosumnes River, and removal of low-flow barriers to adult fall-run chinook salmon immigration. Preliminary modeling conducted for the Cosumnes River Basin has shown that a substantial reduction in basin groundwater pumping could result in surface flow continuity being restored to the lower reaches of the Cosumnes River as early as October (K. Whitener, The Nature Conservancy, Project Ecologist, pers. comm., October 20, 2000). Removal of the low-flow barriers to adult fish passage would involve a combination of instream flow restoration and physical barrier modification/removal. Specific discussions on how these planned future actions could affect fall-run chinook salmon and steelhead use of both the Cosumnes River and Deer Creek are provided below.

3.2.3.2.1 Effects on Fall-run Chinook Salmon use of the Cosumnes River and Deer Creek

The future restoration actions planned for the Cosumnes River have the potential to improve upstream immigration and spawning success of the river's fall-run chinook salmon population. Successful restoration will improve adult passage to upstream spawning habitat during the October through December peak spawning period. The planned restoration actions would not affect the seasonal flow or water temperature regimes of Deer Creek. Consequently, the timing and ability of fall-run chinook salmon to immigrate through the lower and middle reaches of Deer Creek to reach suitable spawning habitat (located approximately 20 miles upstream from the creek's confluence with the Cosumnes River) would be similar to existing conditions.

Augmentation of Cosumnes River flows during the fall to benefit fall-run chinook salmon could decrease the tendency for salmon to stray into Deer Creek, relative to existing conditions. This is because the unaffected Deer Creek flows would then constitute a smaller proportion of Cosumnes River flow at the confluence of the two water bodies, thereby providing lesser attraction to immigrating fish than occurs under current hydrologic conditions. Conversely, an increase in run size of Cosumnes River fall-run chinook salmon could increase the potential for straying into Deer Creek. Overall, implementation of the proposed Cosumnes River restoration actions would be expected to have negligible effects on the potential for opportunistic use of Deer Creek by fall-run chinook salmon.

3.2.3.2.2 Effects on Steelhead use of Cosumnes River and Deer Creek

The planned restoration actions are not expected to create a run of steelhead in the Cosumnes River. This is because the actions would not remove or modify the factor(s) currently preventing establishment of a steelhead run in the river (e.g., the natural barrier that prevents steelhead from accessing the upper reaches of the river) (K. Whitener, The Nature Conservancy, Project Ecologist, pers. comm., October 20, 2000). Because the future restoration actions would not affect steelhead use of the Cosumnes River, they would not change the potential for opportunistic use of Deer Creek by steelhead in the future.

4 WATER QUALITY OBJECTIVES

Water quality objectives are established in Basin Plans by the Regional Board to protect beneficial uses. Water quality objectives provide a specific basis for the measurement and maintenance of water quality parameters. The proposed Basin Plan amendment identifies site-specific, numeric modifications to the basin-wide temperature objective for Deer Creek.

Development of water quality objectives requires, at a minimum, consideration of the following elements (Porter-Cologne Water Quality Control Act, Chapter 4, Article 3, Section 13241):

- past, present, and probable future beneficial uses;
- environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;
- water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;
- economic considerations;
- the need for developing housing within the region; and
- the need to develop and use recycled water.

A discussion of each of these elements is provided below. A brief history of the development of water quality criteria can be found in Appendix A.

4.1 CURRENT BASIN PLAN TEMPERATURE OBJECTIVE FOR DEER CREEK

The current Basin Plan (RWQCB 1998) temperature objectives are stated as follows:

“The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alternation in temperature does not adversely affect beneficial uses.

...At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature. Temperature changes due to controllable factors shall be limited for the water bodies specified as described in Table III-4. To the extent of any conflict with the above, the more stringent objective applies.

In determining compliance with the water quality objectives for temperature, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.”

**TABLE III-4
SPECIFIC TEMPERATURE OBJECTIVES**

DATES	APPLICABLE WATER BODY
<i>From 1 December to 15 March, the maximum temperature shall be 55°F. From 16 March to 15 April, the maximum temperature shall be 60°F. From 16 April to 15 May, the maximum temperature shall be 65°F. From 16 May to 15 October, the maximum temperature shall be 70°F. From 16 October to 15 November, the maximum temperature shall be 65°F. From 16 November to 30 November, the maximum temperature shall be 60°F.</i>	<i>Sacramento River from its source to Box Canyon Reservoir (9); Sacramento River from Box Canyon Dam to Shasta Lake (11)</i>
<i>The temperature in the epilimnion shall be less than or equal to 75°F or mean daily ambient air temperature, whichever is greater.</i>	<i>Lake Siskiyou (10)</i>
<i>The temperature shall not be elevated above 56°F in the reach from Keswick Dam to Hamilton City nor above 68°F in the reach from Hamilton City to the I Street Bridge during periods when temperature increases will be detrimental to the fishery.</i>	<i>Sacramento River from Shasta Dam to the I Street Bridge (13, 30)</i>

The 5°F increase limitation is the component of the current Basin Plan temperature objectives that is applicable to Deer Creek.

4.2 ORIGIN OF THE CURRENT BASIN PLAN TEMPERATURE OBJECTIVE

McKee and Wolf (1963) reported that, if the temperature of a reach of stream is raised by 9-18°F (5-10°C), it is probable that coldwater game fish will avoid the reach and that they will be replaced by warmwater fish. This statement is reflective of the early regulatory thinking with regard to controlling temperature in ambient waters, which was to limit the *change* in temperature from “normal conditions.” Basing regulatory recommendations on this concept, as well as the concept that species- and life-stage-specific maximum temperatures should not be exceeded, the Federal Water Pollution Control Administration stated the following as part of its temperature criteria for the protection of both warmwater and coldwater aquatic biota (FWPCA 1968):

“To maintain a well-rounded population of warm-water fishes, the following restrictions on temperature extremes and temperature increases are recommended:

- (1) During any month of the year heat should not be added to a stream in excess of the amount that will raise the temperature of the water (at the expected minimum daily flow for that month) more than 5°F.*
- (2) The normal daily and seasonal temperature variations that were present before the addition of heat due to other than natural causes should be maintained.*
- (3) The recommended maximum temperatures that are not to be exceeded for various species of warm-water fish are given in table III-1.”*

In addition, recommendations or criteria were stated for temperature in lakes. The criteria stated for coldwater bodies was identical to those stated above for warmwater

bodies, with the exception that the maximum species- and life-stage-specific temperatures provided in Table III-1 [of FWPCA (1968)] differed for warmwater and coldwater biota.

Based on a review of the evolution of water quality criteria between publication of McKee and Wolf (1963) to publication of the U.S. EPA's "Gold Book" (USEPA 1986) conducted as part of preparing this report, it is believed that the 1968 national criteria stated above served as the basis for development of the current Basin Plan temperature objective. No quantitative requirement limiting acceptable change from ambient conditions (i.e., the "delta 5°F" requirement stated above) occurs in the U.S. EPA's 1972 (USEPA 1973), 1976 (USEPA 1976) or 1986 (USEPA 1986) water quality criteria documents. Communications with J. Bruns (Chief of the Sacramento River Watershed Section) and J. Marshack (Staff Environmental Scientist of the Environmental/Technical Support Units) of the Regional Board confirmed that McKee and Wolf (1963) and FWPCA (1968) served as the basis for the current Basin Plan temperature objective. The 5°F objective first appeared in the 1975 Water Quality Control Plan for the Central Valley Region.

4.3 CURRENT APPLICABILITY OF THE BASIN PLAN TEMPERATURE OBJECTIVE TO DEER CREEK

Aquatic organisms have upper and lower acute and chronic temperature limits, optimum temperatures for growth, preferred temperatures in thermal gradients, and temperature limitations for migration, spawning, and egg incubation and other key activities (USEPA 1973). In its 1972 water quality criteria, the U.S. EPA stated the following as part of the technical discussion presented regarding development of temperature criteria for the protection of aquatic life (USEPA 1973):

"The general difficulty in developing suitable criteria for temperature (which would limit the addition of heat) lies in determining the deviation from "natural" temperature that a particular body of water can experience without suffering adverse effects on its biota.... In view of the many variables, it seems obvious that no single temperature requirement can be applied uniformly to continental or large regional areas; the requirements must be closely related to each body of water and to its particular community of organisms, especially the important species found in it.... Since thermal requirements of various species differ, the social choice of the species to be protected allows for different 'levels of protection' among water bodies as suggested by Doudoroff and Shumway (1970) for dissolved oxygen.... Criteria for making recommendations for water temperature to protect desirable aquatic life cannot be simply a maximum allowed change from 'natural temperatures.' This is principally because a change of even one degree from an ambient temperature has varying significance for an organism, depending upon where the ambient level lies within the tolerance range [for that organism]." (emphasis added)

To identify the relevance of these statements within the context of Deer Creek, the following seasonal and daily temperature scenarios for Deer Creek are provided. During the fall, winter, and spring period of the year, temperatures in Deer Creek frequently range between 48°F and 61°F (9°C and 16°C) (Appendix C, Figures C-3 through C-5). At such temperatures, an increase of 5°F (2.8°C) would not be expected to result in any adverse impact to individual aquatic organisms, or result in any adverse ecological change. Hence, it is scientifically defensible to suggest that, for this time of the year, a delta 5°F (2.8°C) regulation is unnecessarily restrictive for Deer Creek. Conversely, during July and August, temperatures in Deer Creek occasionally exceed 80°F (26.7°C) upstream of the DCWWTP. Allowing effluent discharges to increase downstream temperatures to about 85-86°F (30°C) could result in adverse thermal impacts to several fish and macroinvertebrate species of Deer Creek. Hence, during this period of the year, the current Basin Plan 5°F limit may not provide an adequate level of protection to Deer Creek's aquatic life.

During the summer months, diurnal fluctuations in Deer Creek temperature upstream of the DCWWTP are frequently 12-14°F (7-8°C) (SWRI 1997). For example, on July 15, 1997, the temperature in Deer Creek at the R1 gaging station reached a high of 81.3°F (27.4°C) in the afternoon, and a low of 67.2°F (19.6°C) in the early, pre-dawn hours. A 5°F (2.8°C) increase in creek temperature during the early hours would not be expected to have resulted in any adverse impacts to the creek's aquatic biota. Conversely, a 5°F (2.8°C) increase when creek temperatures were at or near the daily high could have resulted in adverse impacts to one or more organisms residing in the creek. Hence, when applied to Deer Creek during the summer period, the current Basin Plan 5°F temperature objective can defensibly be regarded as both unnecessarily restrictive and not protective enough, within a single 24-hour period.

Based on the above discussion, development of site-specific, numeric temperature objectives for Deer Creek is technically justified.

4.4 ALTERNATIVES CONSIDERED

For a description of the purpose and need for the proposed Basin Plan amendment, refer to Section 1.1.3 of this Staff Report. Three alternatives were considered for developing an amendment to the temperature objective currently applicable to Deer Creek. These alternatives are: 1) no action; 2) adoption of the U.S. EPA national ambient criteria for temperature; and 3) adoption of a site-specific, numeric temperature objectives for Deer Creek. The criteria used for selecting the recommended alternative included:

- 1) consistency with State and federal water quality laws and policies;
- 2) level of beneficial use protection;
- 3) consistency with current science regarding water quality necessary to reasonably protect specified beneficial uses; and
- 4) applicability to Deer Creek, a seasonally effluent-dominated water body.

4.4.1 Alternative 1 – No Action

Under this alternative, the current Basin Plan water quality objective for temperature would remain unchanged and would continue to apply to Deer Creek.

4.4.2 Alternative 2 – Adopt U.S. EPA National Criteria

Under this alternative, the current U.S. EPA national ambient criteria for temperature in fresh waters would be applied to Deer Creek as a water quality objective in the Basin Plan. The current national temperature criteria is as follows (USEPA 1986; USEPA 1999):

“Criteria:

Freshwater Aquatic Life:

For any time of the year, there are two upper limiting temperatures for a location (based on the important sensitive species found there at the time):

- 1. One limit consists of a maximum temperature for short exposures that is time dependent and is given by the species-specific equation:*

$$\text{Temperature } (^{\circ}\text{C}) = (1/b) (\log_{10} [\text{time in min}] - a) - 2^{\circ}\text{C}$$

where: \log_{10} = logarithm to base 10 (common logarithm)

a = intercept on the “y” or logarithmic axis of the line fitted to experimental data and which is available for some species from Appendix II-C, National Academy of Sciences 1974 document [cited as USEPA 1973 in this report].

b = slope of the line fitted to experimental data and available for some species from Appendix II-C, of the National Academy of Sciences document [USEPA 1973].

- 2. The second value is a limit on the weekly average temperature that:*
 - a. In the cooler months (mid-October to mid-April in the north and December to February in the south) will protect against mortality of important species if the elevated plume temperature is suddenly dropped to the ambient temperature, with the limit being the acclimation temperature minus 2°C when the lower lethal threshold temperature equals the ambient water temperature (in some regions this limitation may also be applicable in summer).*
 - or*
 - b. In the warmer months (April through October in the north and March through November in the south) is determined by adding to the physiological optimum temperature (usually for growth) a factor calculated as one-third of the difference between the ultimate upper incipient lethal temperature and the optimum temperature for the most sensitive important*

species (and appropriate life state) that normally is found at that location and time.

or

- c. During reproductive seasons (generally April through June and September through October in the north and March through May and October through November in the south) the limit is that temperature that meets site-specific requirements for successful migration, spawning, egg incubation, fry rearing, and other reproductive functions of important species. These local requirements should supercede all other requirements when they are applicable.*

or

- d. There is a site-specific limit that is found necessary to preserve normal species diversity or prevent appearance of nuisance organisms.”*

4.4.3 Alternative 3 – Develop Site-specific, Numeric Temperature Objectives

Under this alternative, seasonal (i.e., period-specific), numeric temperature objectives protective of Deer Creek’s aquatic life and other beneficial uses would be developed. Its development would consider the current science regarding temperature regulation in freshwaters, site-specific chemical, physical, and biological characteristics of Deer Creek, availability of thermal tolerance data for fish species present in Deer Creek, and regulatory application of the site-specific objective.

4.5 RECOMMENDED ALTERNATIVE

Alternative 3 is recommended, which would facilitate the development of site-specific, numeric temperature objectives for Deer Creek. Alternative 2 (U.S. EPA National Criteria) does not provide for development of definitive temperature criteria because insufficient thermal tolerance data are available for Deer Creek fish species to calculate temperature criteria according to U.S. EPA’s equations. However, Alternative 2 does provide a technical criteria derivation framework that was incorporated into Alternative 3. The selected approach satisfies the selection criteria since the action would:

- 1) be consistent with State and federal water quality laws and policies;
- 2) facilitate development of an objective that would be protective of Deer Creek’s beneficial uses;
- 3) improve the scientific basis upon which the water quality objective is based; and
- 4) allow the Regional Board to reasonably address a key regulatory issue associated with Deer Creek temperature that is, in large part, a function of the creek being a seasonally effluent-dominated water body.

Adoption of Alternative 1 (No Action) would not result in demonstrable benefits to any of Deer Creek’s beneficial uses, and would be inconsistent with the current science and federal guidance regarding temperature regulation in ambient freshwaters. Moreover,

Alternative 1 would provide a substantially lower level of thermal protection to Deer Creek's aquatic life during the critical summer period, when creek water temperatures reach annual highs.

4.6 PROPOSED TEMPERATURE OBJECTIVE

It is proposed that the following language be added to the temperature objective section of Basin Plan (Section III, pg. 8):

"For Deer Creek, source to Cosumnes River, temperature changes due to discharges shall not cause creek temperatures to exceed the objectives stipulated in Table III-4A."

TABLE III-4A
SPECIFIC TEMPERATURE OBJECTIVES FOR DEER CREEK

Date	Daily Maximum (°F) ^a	Monthly Average (°F) ^b
January and February	63	58
March	65	60
April	71	64
May	77	68
June	81	74
July through September	81	77
October	77	72
November	73	65
December	65	58

^a Maximum not to be exceeded.

^b Defined as a calendar month average.

Regulation of Deer Creek temperature should consider both the multiple thermal requirements of aquatic species and requirements for balanced communities. As stated by the U.S. EPA in its 1972 criteria document (USEPA 1973), site-specific temperature limits should undergo periodic reexamination as knowledge of thermal effects on site-specific aquatic species and communities increases over time. In its 1972 criteria document (USEPA 1973), from which the bullets provided below are taken (and reiterated in its 1976 (USEPA 1976) and 1986 (USEPA 1986) water quality criteria), the U.S. EPA defined the following requirements as necessary of consideration when developing site-specific temperature criteria to protect aquatic life:

- maximum sustained temperatures that are consistent with maintaining desirable levels of productivity;
- temperature limitations for survival of brief exposures to temperature extremes, both upper and lower;
- restricted temperature ranges, as necessary and appropriate, to protect distinct life stages of important organisms; and
- seasonal temperature regimes that will provide for diverse compositions of species of aquatic communities.

In developing the proposed site-specific temperature objectives for Deer Creek, substantial consideration was given not only to the current U.S. EPA criteria, but also to the “evolution” in technical concepts and approaches recommended in national water quality criteria documents. The criteria below are consistent with the U.S. EPA’s current national temperature criteria (Section 4.4.2), and are believed to represent the most technically defensible manner for regulating temperatures in Deer Creek for the protection of aquatic life.

4.7 SCIENTIFIC BASIS FOR THE SITE-SPECIFIC TEMPERATURE OBJECTIVE PROPOSED FOR DEER CREEK

4.7.1 Approach and Technical Basis for Deriving Objectives

The aquatic life uses of Deer Creek are the beneficial uses most sensitive to water temperature. U.S. EPA’s guidance for deriving temperature criteria for a specific water body recommends the combined use of site-specific biological information and thermal tolerance data from the scientific literature, to the degree available and relevant, to develop scientifically defensible, seasonal temperature objectives. Appendix D provides technical discussions on the following topics:

- effects of temperature on aquatic life;
 - range of tolerable temperatures;
 - influence of temperature on habitat selection by fish;
 - effects of rapid temperature change on aquatic life;
- aquatic biota of Deer Creek and their thermal tolerances;
 - fish community; and
 - benthic macroinvertebrate community.

Numerous technical factors (in addition to thermal tolerance data) need to be considered in developing reasonable, site-specific temperature objectives for Deer Creek. To help guide the objective-development process to the desired outcome, the “goal” or “purpose” of the objectives to be developed was defined as follows:

To produce a set of seasonal, site-specific, numeric temperature objectives that will protect and maintain Deer Creek’s existing and potential aquatic life uses.

The seasonal temperature regime of a water body has substantial influence on the aquatic ecology that develops and is maintained in the water body. Substantial and ecologically significant changes to the existing seasonal temperature regime of Deer Creek, be they in a “warmer” or “colder” direction, have the potential to change the creek’s aquatic life uses relative to existing conditions and conditions believed to have occurred prior to effluent discharges (see Section 3.2.2). The site-specific temperature objectives developed for Deer Creek are not intended to change the creek’s current or

potential aquatic life uses, but rather are intended to protect and maintain existing and potential uses both in the near-term and in the future.

Based on the approach selected and the goal defined, a “two-step” process for deriving scientifically defensible and appropriate temperature objectives for Deer Creek was used. The first step was to compile the available scientific literature pertaining to thermal requirements of the fish and benthic macroinvertebrates documented to occur in Deer Creek. The second step involved compiling available biological data characterizing the diversity, structure, and general condition of the current fish and benthic macroinvertebrate communities of the creek, both upstream and downstream of the DCWWTP. These data were then integrated with the literature thermal requirement data to establish a sound scientific basis from which to propose a set of seasonal temperature objectives that would protect and maintain Deer Creek’s existing and probable future aquatic life uses. Each of these components of the objective-development process is discussed further below.

4.7.1.1 *Compilation of Available Literature on Thermal Requirements of Deer Creek’s Aquatic Life for Use in Developing Temperature Objectives*

A compilation of available literature on the thermal requirements of aquatic life documented to use Deer Creek is provided below, and in Appendix D. The available thermal tolerance data for fish species documented to use Deer Creek is summarized in **Table 4** and Appendix D, Table D-1. As shown in Table 4, extensive, specific thermal tolerance data are available for some of Deer Creek’s resident fish species that occur in the vicinity of the DCWWTP (i.e., bluegill, green sunfish, mosquitofish, and California roach). Conversely, comparatively little and less specific thermal tolerance data are available for the creek’s other species (i.e., Sacramento pikeminnow, Sacramento sucker, hardhead, prickly sculpin) that occur in this portion of the creek.

As part of this first step to compile the available scientific literature pertaining to thermal requirements of Deer Creek fishes, short-term (i.e., acute) and/or long-term (i.e., chronic) temperature criteria were calculated for all creek fish species for which sufficient data are available, following U.S. EPA’s current guidance for deriving temperature criteria (USEPA 1986). Acute and/or chronic criteria were calculated for bluegill, green sunfish, mosquitofish, and California roach (**Table 5**). In addition, criteria were calculated for golden shiner, largemouth bass, and smallmouth bass, which were documented in 1999 by Nature Conservancy/U.C. Davis investigators to occur in the creek near its confluence with the Cosumnes River. Finally, U.S. EPA criteria were calculated for white sucker (*Catostomus commersoni*), channel catfish (*Ictalurus punctatus*), and longear sunfish (*Lepomis megalotis*), which are relatives (i.e., members of the same Genus) of the Sacramento sucker, black bullhead, and green sunfish, respectively (**Table 6**). Both Sacramento sucker and green sunfish occur in Deer Creek immediately downstream of the DCWWTP, whereas black bullhead have been found only near the confluence with the Cosumnes River (see Table 1).

Table 4. **Summary of literature information on thermal requirements of fish species documented in Deer Creek, in the vicinity of the DCWWTP.**

Fish Species	Approximate Upper Temp. Limit (°F) (< 24 hr. Exposure)	Approximate Preferred Temps. (°F)	Reference	Presence in Deer Creek	
				Upstream of DCWWTP ^a	Downstream of DCWWTP ^a
Bluegill	low 90s to 106	up to low 80s	Becker 1983 McKee & Wolf 1963 USEPA 1973	abundant	abundant
California Roach	upper 90s to 100	mid 70s to mid 80s	Cech et al. 1985 Cech et al. 1990	abundant	uncommon
Green sunfish	low to upper 90s	low 80s	Becker 1983	common	common
Mosquitofish	mid 80s to upper 90s	upper 70s to low 80s	Cech et al. 1985 McKee & Wolf 1963 USEPA 1973	common	abundant
Hardhead	upper 70s to mid 80s	mid 60s to low 80s	Cech et al. 1990	--	abundant
Sacramento sucker	upper 70s to mid 80s	mid 60s to low 80s	Cech et al. 1990 McKee & Wolf 1963 USEPA 1973	--	abundant
Sacramento pikeminnow	up to mid 80s	mid 60s to upper 70s	Cech et al. 1990 Black 1953	--	abundant
Prickly sculpin	mid 70s to low 80s	mid 60s to upper 70s	Brown et al. 1995 Black 1953 Cech et al. 1990	--	common
Rainbow trout	mid to upper 70s	mid 50s to mid 60s	USEPA 1973 Alabaster & Lloyd 1980 Sanders 1996 Evans 1990 Baltz et al. 1987 McKee & Wolf '63	b	b

^a The terms "abundant", "common", and "uncommon" refer to the frequency with which species were captured during surveys: Abundant = frequently captured; common = commonly captured; and uncommon = infrequently captured.

^b Only three rainbow trout were observed among all five fish surveys, and all were observed by CDFG in 1994. The CDFG sampling was not conducted in a manner conducive to estimating relative abundance.

Table 5. U.S. EPA Gold Book temperature criteria calculated for Deer Creek fish species occurring in the vicinity of the DCWWTP.

Fish species	Acclimation Temp (°C)	Acute Temperature Criteria						Chronic Temperature Criteria				
		"a"	"b"	Time (min)	Maximum Temperature Criteria (°C)	Maximum Temperature Criteria (°F)	Reference	Optimum Temperature (°C)	Upper Incipient Lethal Temperature (°C)	Maximum Temperature Criteria (°C)	Maximum Temperature Criteria (°F)	Reference
Bluegill	25	23.8733	-0.632	120	32.5	90.5	USEPA 1973, App. II-C, p. 413	24.5	33.8	27.6	81.7	USEPA 1973, Table III-12, p. 160; Becker 1983, p. 848
Green sunfish	--	--	--	--	--	--	--	27.5	34.8	29.9	85.9	Becker 1983, p. 826
Mosquitofish	25	39.0004	-0.9771	120	35.8	96.4	USEPA 1973, App. II-C, p. 412	26.5	37	30.0	86.0	USEPA 1973, App. II-C, p. 412; Cech et al. 1985
California roach	--	--	--	--	--	--	--	26.5	36	29.7	85.4	Cech et al. 1985, 1990

References:

- Becker, G. C. 1983. Fishes of Wisconsin. The University of Wisconsin Press, Madison, WI. 1052 pp.
- Cech, J.J., Jr., M.J. Massingill, B.Vondracek, and A.L. Linden. 1985. Respiratory metabolism of mosquitofish, *Gambusia affinis*: effects of temperature, dissolved oxygen, and sex difference. Environmental Biology of Fishes 13:297-307.
- Cech, J.J., Jr., S. J. Mitchell, D. T. Castleberry, and M. McEnroe. 1990. Distribution of California stream fishes: influence of environmental temperature and hypoxia. Environmental Biology of Fishes 29:95-105.
- USEPA (United States Environmental Protection Agency). 1973. Water quality criteria 1972. A report of the Committee on Water Quality Criteria. Prepared by the National Academy of Sciences and National Academy of Engineering. U.S. Environmental Protection Agency, Washington, D.C. EPA-R3-73-033. 594 pp.

Table 6. U.S. EPA Gold Book temperature criteria calculated for additional Deer Creek fish species and their relatives.

Fish species	Acclimation Temp (°C)	Acute Temperature Criteria						Chronic Temperature Criteria				
		"a"	"b"	Time (min)	Maximum Temperature Criteria (°C)	Maximum Temperature Criteria (°F)	Reference	Optimum Temperature (°C)	Upper Incipient Lethal Temperature (°C)	Maximum Temperature Criteria (°C)	Maximum Temperature Criteria (°F)	Reference
White sucker	25	22.2209	-0.6277	120	30.1	86.2	USEPA 1973, App. II-C, p. 410	27	29.3	27.8	82.0	USEPA 1973, Table III-12, p. 160
Channel catfish	25	46.2155	-1.2899	120	32.2	90.0	USEPA 1973, App. II-C, p. 413	30	38	32.7	90.8	USEPA 1973, Table III-12, p. 160
Longear sunfish	25	35.4953	-0.9331	120	33.8	92.9	USEPA 1973, App. II-C, p. 413	--	--	--	--	--
Largemouth bass	25	19.9918	-0.5123	120	33.0	91.3	USEPA 1973, App. II-C, p. 413	27.5	36.4	30.5	86.8	USEPA 1973, Table III-12, p. 160
Smallmouth bass	--	--	--	--	--	--	--	26.3	35	29.2	84.6	USEPA 1973, Table III-12, p. 160
Golden shiner	25	34.2505	-0.9226	120	32.9	91.2	USEPA 1973, App. II-C, p. 414	--	--	--	--	--

References:

USEPA (United States Environmental Protection Agency). 1973. Water quality criteria 1972. A report of the Committee on Water Quality Criteria. Prepared by the National Academy of Sciences and National Academy of Engineering. U.S. Environmental Protection Agency, Washington, D.C. EPA-R3-73-033. 594 pp.

The U.S. EPA equations used to calculate the acute and chronic criteria are provided on pages 273 and 283 of U.S. EPA's "Gold Book" (USEPA 1986). The criteria calculated, and species-specific references to the literature data used for criteria calculation, are provided in Table 5 and Table 6.

The acute temperature criteria calculated were for an exposure-duration of 120 minutes (2 hours). This duration was selected to simulate the maximum length of time during the day that peak daily temperatures would be expected to occur in the creek (i.e., two hours during late afternoon). Acute criteria were calculated for seven species (bluegill, mosquitofish, white sucker, channel catfish, longear sunfish, largemouth bass, and golden shiner). The acute criteria calculated ranged from a low of 86.2°F for white sucker to a high of 96.4°F for mosquitofish (Table 5 and Table 6). Similarly, chronic (one week exposure) criteria were calculated for eight species (bluegill, green sunfish, mosquitofish, California roach, white sucker, channel catfish, largemouth bass, and smallmouth bass). The U.S. EPA chronic criteria calculated ranged from lows of 81.7/82.0°F for bluegill and white sucker, respectively, to a high of 90.8°F for channel catfish (Table 5 and Table 6).

The data available for the benthic macroinvertebrate community is very limited (Appendix D, Table D-3), with no thermal tolerance data available for most species.

Based on the thermal requirements of the fish species using Deer Creek in the vicinity of the DCWWTP and the current seasonal temperature regime that occurs in the creek (Appendix C and D), it can be concluded that the creek provides suitable rearing temperatures the majority of the time for all species found in the creek except rainbow trout. Limited data are available in the literature regarding spawning temperatures for Deer Creek's fish species (Appendix D, Table D-2; USEPA 1986).

4.7.1.2 *Technical Shortcomings of Deriving Temperature Objectives from Literature Data Alone*

There are several important shortcomings in attempting to develop a scientifically defensible set of seasonal temperature objectives for a water body by using scientific literature data alone. These are briefly discussed below.

First, in the case of Deer Creek, the scientific literature provides significant useful thermal tolerance data for many of the aquatic species using the creek (Appendix D). However, the literature does not clearly define the timing of the different life stages for all the fish and macroinvertebrates known to occur in the creek, nor does it provide *thermal requirements* (i.e., upper thermal limits for defined exposure periods) for all species and life stages. For example, no data were found in the scientific literature defining suitable spawning temperatures for hardhead, a native California fish species that is present in Deer Creek. Spawning temperature data provided by Moyle (1976) for many of the other native species (e.g., Sacramento sucker, Sacramento pikeminnow, prickly sculpin) (Appendix D, Table D-2) are generally based on observations of temperature that occurred in various water bodies when these species were observed

to be spawning. This is distinctly different from data generated from laboratory experiments that actually determine *upper thermal limits* to successful egg development, incubation, and hatching. Hence, the literature provides a range of temperatures under which the fish are known to spawn, but does not definitively indicate what the maximum temperature at which successful spawning will occur. One cannot identify an appropriate upper temperature limit, based on the “most sensitive species,” when the literature information does not clearly define: 1) upper temperature limits for each species and life stage; and 2) when the species conduct each of their life stages throughout the year.

Second, unless the species has been well studied by multiple researchers in many different water bodies, the applicability of the reported literature information to the water body in question is uncertain. This uncertainty is a function of: 1) the extent and quality of the findings reported; and 2) the applicability of thermal requirements, if reported, of a species that has evolved in one system to the same species that occurs in another system.

Third, a given life stage of a particular aquatic species does not thrive at one specific temperature or even narrow range of temperatures and perish at temperatures just outside that range. Rather, each species has evolved to be able to successfully carry out each of its life stages at a relatively broad range of temperatures. Some species are more thermally tolerant than others (i.e., can conduct their life cycle over a very broad range of temperatures), but all can function within a given range of temperatures. Adverse effects occur when temperatures are outside the species’ “adaptable” or “suitable” range. Species have evolved such “thermal elasticity” to assure survival from year to year in the face of wide inter-annual variation in ambient water temperatures for specific times of the year. For example, recent research from U.C. Davis (Cech and Myrick 1999) has demonstrated that Central Valley chinook salmon and steelhead, which exist at the southern end of their species’ geographic range, show substantially greater thermal tolerance than many populations of the same species that occur to the north (e.g., British Columbia and Alaska).

Fourth, many aquatic species can shift when they conduct certain life stages (e.g., spawning) by weeks and even months in order to conduct that life stage when temperatures are suitable. This, of course, is not the case for other life stages such as adult and juvenile rearing, which need to take place throughout the year.

Fifth, temperatures that are highly suitable for one species of fish or macroinvertebrate during a given month of the year may be outside the suitable range for another species documented to co-exist in the same water body. Natural aquatic ecosystems involve a complex overlapping of life stages of numerous aquatic species, all with distinct thermal requirements for their various life stages. In nature, all species do not exist under ideal conditions at all times.

In short, because the literature contains data gaps (i.e., does not provide an equal breadth of thermal tolerance data for all species), working strictly from the thermal

requirements literature to determine a set of temperature objectives for Deer Creek is simply infeasible.

To ensure that a technically sound and unbiased scientific basis is established from which to develop temperature objectives for a given water body, it is important to compare and integrate thermal tolerance information obtained from the scientific literature with biological assessment data obtained from conducting site-specific field surveys (USEPA 1973, 1986). For example, reliance on the limited thermal tolerance literature alone might lead one to conclude that Deer Creek summer water temperatures, downstream of the DCWWTP, are too high to support healthy, self-sustaining populations of Sacramento pikeminnow and prickly sculpin. This conclusion is incorrect, however, because five fish surveys of Deer Creek, conducted between 1993 and 1999 by qualified fish biologists, have repeatedly demonstrated that healthy, self-sustaining populations of Sacramento pikeminnow and prickly sculpin exist in the creek downstream of the DCWWTP. Conversely, the more extensive thermal tolerance literature available for rainbow trout indicate that Deer Creek summer water temperatures, both above and below the DCWWTP, are too high to support healthy, self-sustaining populations of rainbow trout. The 1993 through 1999 fish-survey data collected for Deer Creek document that a healthy, self-sustaining population of rainbow trout does not exist in the creek, either upstream or downstream of the DCWWTP.

It can be seen from these two examples that site-specific field data are useful in supporting or refuting technical conclusions drawn from literature information alone. Site-specific field data are most helpful in this regard when literature data are sparse or otherwise limited.

4.7.1.3 Compilation of Available Deer Creek Biological Data for Use in Developing Temperature Objectives

4.7.1.4 Deer Creek Aquatic Life

When developing site-specific temperature objectives for a particular water body, scientists typically encounter data gaps and other shortcomings of the scientific literature. When this occurs, scientists often let the organisms present in the water body in question “*speak for themselves*” regarding temperature levels that will protect and maintain their current populations and communities. This is accomplished by: 1) conducting biological assessments of fish and benthic macroinvertebrate communities and evaluating, based on data collected as part of these assessments, the diversity, structure, sustainability, and overall ecological health of the communities present; and 2) documenting the temperature regime and other conditions under which the communities exist, and have existed in past years. The diversity, structure, sustainability, and overall ecological health of the communities present are a function of the physical, chemical, and biological conditions that have occurred in the past, and presently occur, in the water body.

Data collected from field surveys can be integrated with literature values (pertaining to thermal limits and suitable temperature ranges) to serve as the technical basis to develop a scientifically defensible set of seasonal temperature objectives. This

integration of field-collected biological data with the available literature on thermal tolerances of individual species constituted the second step of the temperature objective development process for Deer Creek.

A summary of available biological data on Deer Creek is summarized and discussed in Section 3.2.1.1 of this Staff report. By making use of field survey data, the organisms of the creek, in essence, are telling us the adequacy of their existing conditions. This is the underlying scientific premise of biological assessments. Conceptually, the exact thermal limits of each life stage of all species need not be known to develop a set of temperature objectives that would protect and maintain a water body's existing aquatic life uses. If field surveys determine that the aquatic communities present are healthy, diverse, self-sustaining, and typical for the water body in question, then the seasonal temperature regime that occurs in that water body has, in part, been responsible for maintaining those communities in their documented condition. From the perspective of temperature regulation, the simplest way to continue to protect and maintain those communities in the future is to establish temperature objectives (i.e., limits) that effectively maintain the current seasonal temperature regime in the future.

Available biological assessment data (collected in the vicinity of the DCWWTP) indicate that Deer Creek's fish and benthic macroinvertebrate communities, both upstream and downstream of the DCWWTP, are healthy, diverse, self-sustaining, and typical for this water body (see Section 3.2.1.1). The following findings support this statement. Biological assessment data show no loss of species downstream of the DCWWTP that are present upstream, that can be attributed to thermal loading from effluent discharges. The SWRCB, in WR Order No. 95-9 noted that discharge from the DCWWTP supports populations of native and introduced species of fish. The most recent macroinvertebrate surveys conducted by CDFG (1998) and BioAssessment Services (BAS 2001) concluded that the benthic macroinvertebrate metrics and similarity index analyses both indicated that the DCWWTP effluent did not have a large effect on the biotic condition of Deer Creek downstream of the effluent discharge. Even the condition of the macroinvertebrate community existing in the undiluted effluent channel was described by CDFG as satisfactory when compared to the other sites, including upstream sites. Based on these key biological findings, it can be reasonably concluded that the effects of effluent discharges on downstream water temperatures, although measurable, are not currently causing adverse effects on the creek's aquatic communities, relative to communities that exist upstream of the DCWWTP.

As previously stated in this report, no documentation exists that characterizes the aquatic ecology of Deer Creek, downstream of the DCWWTP, prior to 1974 when the plant began discharging to the creek (see Section 3.2.2). Nevertheless, best professional judgment suggests that creek water temperatures downstream of the DCWWTP during the winter months prior to 1974 would have been similar to somewhat colder than current winter temperatures. Summer creek temperatures (e.g., June through August) prior to effluent discharges to the creek would have been similar to or warmer than those that exist today. Finally, fall water temperatures (e.g., September through November) would have been colder than current conditions. Because summer

temperatures would have been similar to or warmer than current conditions, the same thermal limitations to year-round use of the creek by warmwater and coldwater species that exists today would have occurred prior to 1974. Consequently, the species of fish and benthic macroinvertebrates that established healthy, self-sustaining populations prior to effluent discharges were likely very similar to those that maintain such populations today.

Based on the above information, it can be reasonably concluded that maintenance of Deer Creek's current seasonal temperature regime would effectively protect and maintain Deer Creek's existing and potential aquatic life uses, which are appropriate for this water body and are currently in good condition.

4.7.1.5 Summary

The following points summarize the above discussions, and the scientific approach/technical basis used to develop the proposed set of seasonal temperature objectives for Deer Creek.

- The goal for development of the temperature objectives was protecting and maintaining Deer Creek's existing and potential aquatic life uses, being the beneficial uses most sensitive to creek temperatures.
- The available scientific literature pertaining to thermal requirements of Deer Creek's aquatic life was compiled. It provides useful information for the development of site-specific objectives, but contains substantial data gaps that do not facilitate development of scientifically defensible objectives from literature data alone.
- The diversity, structure, and overall condition of Deer Creek's fish and benthic macroinvertebrate communities have been characterized in the vicinity of DCWWTP. None of the available biological data indicate that the effects of effluent discharge on creek temperature adversely affect the creek's downstream aquatic life uses.
- Scientists that have studied the creek generally agree that the effluent discharged from the DCWWTP contributes to maintaining the current downstream aquatic resources, particularly during the summer and fall months of the year.
- Staff integrated the available scientific literature pertaining to thermal requirements of aquatic organisms documented to use Deer Creek with site-specific biological information to develop the proposed temperature objectives, consistent with the scientific facts and considerations discussed above and the objective development criteria established in Section 4.4 of this Staff Report.

4.7.2 Evaluation of Proposed Temperature Objectives

4.7.2.1 *Beneficial Use Considerations*

4.7.2.1.1 Deer Creek

Existing (see Section 3.2.1) and probable future (see Section 3.2.3) beneficial uses of Deer Creek were considered in developing the recommended site-specific temperature objectives. The beneficial uses of Deer Creek most sensitive to water temperatures are those associated with aquatic life (i.e., freshwater habitat, migration and spawning WARM/COLD uses). Thus, temperature objectives that protect and maintain the creek's aquatic life uses would be temperature-protective of the creek's other existing and probable future beneficial uses.

Staff from the Regional Board, CDFG, NMFS, and the District's consultant cooperatively developed the proposed site-specific temperature objectives for Deer Creek using the approach described above. Objective development also benefited from detailed technical input from The Nature Conservancy. This panel of technical personnel included three biologists: 1) S. Lehr, District Fisheries Biologist for CDFG; 2) K. Whitener, Project Ecologist for The Nature Conservancy; and 3) Dr. M. Bryan, Fisheries Biologist and Aquatic Toxicologist who served as the District's consultant. All three of these biologists have conducted multiple fish and/or benthic macroinvertebrate surveys of Deer Creek between 1994 and present, and are very familiar with the creek's aquatic ecology. The Nature Conservancy biologist also has conducted extensive fishery investigations on the Cosumnes River, to which Deer Creek is tributary. Key aquatic life factors and data considered, and the scientific basis upon which the proposed objectives are based, are discussed in detail under Section 4.7.

The fisheries biologists involved with objective development agreed that the proposed set of site-specific temperature objectives would be protective of Deer Creek's resident, self-sustaining aquatic communities, constituting the WARM use. Project biologists further agreed that the proposed objectives would be protective of the potential for fall-run chinook salmon and steelhead to make opportunistic use of the creek during a portion of the year (i.e., winter/spring months), under certain hydrologic and water temperature conditions. The latter represents the nature of the potential use of the creek by coldwater aquatic biota. The CDFG's support for the proposed objectives is provided in writing in **Appendix E**. CDFG desires to protect the assemblage of resident, native fishes that presently occur in Deer Creek downstream of the DCWWTP, where they are currently maintaining populations in good condition (S. Lehr, CDFG Fisheries Biologist, pers. comm., October 20, 2000). The proposed temperature objectives would protect and maintain the creek's resident fish populations (S. Lehr, CDFG Fisheries Biologist, pers. comm., October 20, 2000; K. Whitener, The Nature Conservancy, Project Ecologist, pers. comm., October 20, 2000).

4.7.2.1.1.1 Key Technical Findings in Support of the Proposed Objectives

Key technical findings that support the proposed site-specific temperature objectives are summarized below.

- The proposed objectives are consistent with U.S. EPA guidance on deriving temperature criteria for freshwater aquatic life (USEPA 1973, 1986, 1999). EPA “Gold Book” temperature criteria (USEPA 1986) were calculated for a number of resident fish species of Deer Creek and several additional species that are closely related (i.e., same Genus) to fish documented to occur in the creek (Table 5 and Table 6). The seven acute criteria calculated ranged from 86.2°F to 96.4°F. The highest acute objective proposed for Deer Creek (for the June through September summer period) is 81°F, which is 5.2-15.4°F lower than the EPA acute temperature criteria calculated. The eight EPA chronic criteria calculated ranged from 81.7°F to 90.8°F. The 77°F maximum chronic criterion proposed for Deer Creek during the summer months is 4.7-13.8°F lower than the eight EPA chronic temperature criteria calculated.
- Available biological assessment data for Deer Creek (see Section 3.2.1.1) indicate that the creek’s fish and benthic macroinvertebrate communities, both upstream and downstream of the DCWWTP, are healthy, diverse, self-sustaining, and typical for this water body. Deer Creek downstream of the DCWWTP currently supports a more diverse, native fish community than is supported upstream of the plant. All fish species present upstream also are present downstream, with downstream reaches supporting additional species not present upstream.
- The benthic macroinvertebrate communities that exist above and below the DCWWTP are highly similar, with all functional feeding groups that are present upstream also being present downstream. From its 1998 bioassessment survey of the creek’s benthic macroinvertebrate communities, CDFG concluded the following (CDFG 1998):

“The BMI [benthic macroinvertebrate] metrics and similarity index analyses both indicated that the WWTP effluent did not have a large effect on the biotic condition of Deer Creek downstream of the effluent discharge. Even the biotic condition of the effluent channel [flows comprised of undiluted effluent] seemed to be satisfactory when compared to the other sites.”
- The seasonal temperature regime that currently occurs in Deer Creek downstream of the DCWWTP (see Appendix C) has protected and maintained healthy and diverse fish and benthic macroinvertebrate communities, and provides for the opportunistic use of the creek below the DCWWTP by fall-run chinook salmon and steelhead. CDFG testified at a 1995 SWRCB water rights hearing (SWRCB 1995) that continued effluent discharge from the DCWWTP into

Deer Creek was necessary to maintain current riparian and aquatic resources sustained by the creek downstream of the plant.

- The effects of effluent discharges on downstream water temperatures, although measurable, are not causing adverse effects on the creek's existing aquatic communities, relative to communities that exist upstream of the DCWWTP (Section 3.2.1.1; CDFG 1998; BAS 2001; S. Lehr, CDFG Fisheries Biologist, pers. comm., October 20, 2000). The proposed objectives were developed to maintain an ecologically equivalent seasonal temperature regime, to that which currently occurs (i.e., a seasonal temperature regime that would provided for the continued maintenance of existing aquatic communities).
- The winter, spring, and summer periods of the year have relatively high ecological importance in maintaining the creek's aquatic communities, particularly fish communities. This is because the winter/spring periods constitute the reproduction and early life stage periods for most fishes present. Seasonal high creek temperatures occur during the summer, which limit both fish and BMI species that can over-summer in the creek. The fall period is of lesser ecological importance for most fish species, regarding thermal conditions. It constitutes the juvenile rearing and adult maintenance period for resident fishes. Regarding BMIs, fall temperatures typically do not thermally limit species presence the way annual high temperatures that occur during summer months do. Fall water temperatures tend to influence factors such as instar growth rates and timing of emergence and typically not species presence/absence or diversity.
- The proposed objectives allow temperature increases due to effluent discharges in the fall that are consistent with the thermal tolerances of the resident aquatic species that reside in Deer Creek during the fall. The proposed temperature objectives are more restrictive in winter, spring, and summer. These greater limitations on temperatures during the winter, spring, and summer provide: 1) thermal protection for sensitive aquatic life stages (e.g., reproduction/early life stages) present in the creek during these months; 2) the potential for opportunistic use of the creek by fall-run chinook salmon and steelhead during the winter and spring periods; and 3) adequate control of thermal loading during the summer months when seasonal high temperatures are reached in the creek.
- A comparison of the proposed site-specific temperature objectives with the current Basin Plan's "delta 5°F" temperature objective, for the period September 9, 1997 through November 29, 2000, shows that the proposed daily high objectives are similarly restrictive or more restrictive than the current Basin Plan objective for nine months of the year (January through September), and are less restrictive during three months (October through December) of the year (see Section 5.3.1).

Based on the above, and the technical input received from CDFG, NMFS, The Nature Conservancy and the District's technical consultant, Regional Board staff conclude that the proposed site-specific temperature objectives are protective of all current and probable future beneficial uses of Deer Creek. Written confirmation that the personal

communications cited in support of this conclusion are accurate and correct are provided in **Appendix F**.

4.7.2.1.1.2 Opportunistic Use of Deer Creek by Anadromous Salmonids

In the event that opportunistic use of Deer Creek by fall-run chinook salmon or steelhead were to occur in the future in a manner not contemplated as part of developing the proposed objectives, the District could potentially implement, should it be demonstrated necessary and feasible, one or more of the following measures to further assure that operations of the DCWWTP would not adversely affect this potential use:

- 1) construction and seasonal operation of cooling towers, and associated facilities, to cool the effluent discharged to the creek;
- 2) seasonal pumping of upstream limestone quarry water into Deer Creek to offset thermal loading from DCWWTP discharges; and/or
- 3) restriction of use of recycled water through May, in years when the potential for opportunistic use of the creek by anadromous salmonids is high, thereby further extending the period of surface flow continuity with the Cosumnes River to further increase the probability of successful emigration of any salmonids potentially produced in the creek.

4.7.2.1.2 Cosumnes River

Weekly monitoring of Deer Creek temperature from the District's R1 water quality monitoring station on Deer Creek (located immediately upstream of the DCWWTP) to Deer Creek's confluence with the Cosumnes River at Hwy 99 (a distance of approximately 36 miles) was conducted by SWRI between February 3, 1998 and March 3, 1998 (Figure 6). Of the dates monitored, the flow rate in Deer Creek was highest on February 3 (when the creek was at flood stage) and declined for all subsequent monitoring events through March 3. During all four sampling events, Deer Creek had visible discharge into the Cosumnes River. However, on March 3, 1998, when Deer Creek and effluent discharges were measured at approximately 28 cfs (18.1 mgd) and 4.9 cfs (3.2 mgd), respectively, the movement (i.e., flow velocity) of Deer Creek into the Cosumnes River was minimal.

The temperature data collected during the February 3, 1998 through March 3, 1998 period demonstrate two important points. First, during high flow conditions associated with significant precipitation events during the winter period, water temperatures in Deer Creek from R1 to Sloughouse differ little (e.g., less than 1°C on February 3 and 16, 1998), and the temperature of the Cosumnes River differs little, if at all, from that of Deer Creek at Sloughouse. This is likely due to large river discharges (which are influenced by ambient air temperatures less than are small discharges) and cool ambient air temperatures. Second, even when Deer Creek temperatures increased measurably with increasing distance downstream from the DCWWTP (e.g., February 26 and March 3, 1998), the Cosumnes River temperature at Wilton Road (prior to mixing

with Deer Creek) and at Hwy 99 (after mixing with Deer Creek) did not differ measurably from each other (Figure 6).

The data discussed above indicate that Deer Creek's influence on Cosumnes River temperature is negligible during the winter period. The data collected between February 3, 1998 and March 3, 1998 further indicate that temperatures in the lower reaches of Deer Creek, under such high-flow conditions, are primarily influenced by ambient air temperatures, surrounding land use, tributary input and water movement.

Although similar quantitative data are not available for the summer/fall, low-flow period, when Deer Creek lacks surface flow continuity with the Cosumnes River, best professional judgment indicates that the effect of Deer Creek water temperatures on that of the Cosumnes River also are negligible during the low-flow periods of the year.

These findings indicate that implementation of the proposed site-specific temperature objectives for Deer Creek would have no measurable effects on Cosumnes River temperatures and thus beneficial uses during any month of the year.

4.7.2.2 Hydrographic Unit Environmental Characteristics Considerations

Adoption of the proposed set of site-specific temperature objectives would not adversely affect the hydrology of Deer Creek or downstream water bodies, relative to existing conditions. Nevertheless, a further characterization of the Deer Creek watershed is provided below for context.

Deer Creek is a small, ephemeral creek draining the lower woodlands of the western Sierra Nevada foothills in El Dorado and Sacramento Counties. Deer Creek is the primary watercourse of its watershed, which covers approximately 87 square miles (56,000 acres) north of Sloughouse. The watershed draining to Deer Creek is very narrow to the south of Sloughouse, with most of the area to the southeast draining to the Cosumnes River and most of the area to the southwest of Sloughouse draining to the lower Sacramento River watershed (Figure 7). This section provides a characterization of the land uses, geology, hydrology, and other key characteristics of the Deer Creek watershed.

4.7.2.2.1 Land Uses

The Deer Creek basin was an undeveloped, rural area until about 1959. At this time, the Cameron Park subdivision was started (EID 1972). The unincorporated communities of Cameron Park and El Dorado Hills have undergone planned and approved growth in the past four decades, resulting in current populations estimated at 14,549 and 18,016, respectively (Shingle Springs/Cameron Park Chamber of Commerce). In a letter from CDFG Regional Manager L. Ryan Broddrick to Mr. Edward Anton, Chief of Division of Water Rights at the SWRCB dated December 23, 1994, CDFG characterized the Deer Creek watershed as follows.

"The upper portion of the watershed has experienced modest residential and light industrial development. The area of the watershed near the WWTP has little or

no development. The area upstream and near Latrobe Road has been developed with small ranchettes. The area downstream of Latrobe Road in Sacramento County is primarily agricultural."

Current land uses are similar to that described by CDFG in its 1994 letter cited above, with some additional business and commercial development having occurred recently in the El Dorado Hills area. Current land uses along Deer Creek include natural, undeveloped woodlands and shrub communities, residential, urban, and agriculture (Figure 7). The District's DCWWTP is the only municipal wastewater treatment plant discharging to Deer Creek.

4.7.2.2.2 Soils and Geology

The Deer Creek watershed lies within the west-central portion of a northwest-trending belt of diverse metamorphic rocks that underlie the western slope of the Sierra Nevada foothills. This region is part of the Sierra Nevada geomorphic province that is typically underlain by Mesozoic Era metavolcanic and metasedimentary bedrock associated with the Bear Mountain Ophiolite Complex. Alluvial deposits are present within the Deer Creek channel and range from discontinuous to locally continuous mixtures of unconsolidated cobbles, gravel, sand, and silt (ESA 1998).

Regarding water infiltration rates, the Deer Creek watershed is characterized by three basic types of soils having distinctly different rates of water infiltration (Figure 8). The upper-most portion of the watershed is characterized by underlying soils having a relatively high percolation or water infiltration rate compared to soils throughout most of the upper watershed and soils of the greater region. Downstream of Highway 50, the creek channel traverses areas characterized by underlying soils and geology (e.g., bedrock and rock outcroppings) that have a very slow water infiltration rate. This results in perennial flows in Deer Creek upstream of the DCWWTP and for a number of miles downstream of the DCWWTP. However, the soils underlying the Deer Creek channel change substantially in the Sloughouse area and in the reach from Sloughouse to the confluence with the Cosumnes River. The lower foothills transition into the valley floor just upstream of the Sloughouse area. In this lower foothill-valley floor transition area near Sloughouse exists a rather extensive area of soils that have a relatively high percolation or water infiltration rate compared to soils throughout the rest of the watershed and the region, and similar to those of the upper-most portion of the watershed. In addition, a band of soils characterized by an infiltration rate that is intermediate between that of the low rate characterizing most of the watershed and the higher infiltration rate of the Sloughouse deposits underlies Deer Creek from just north of Highway 16 to the creek's confluence with the Cosumnes River (Figure Y).

4.7.2.2.3 Hydrology

Deer Creek's headwaters originate just north of Cameron Park Lake at an elevation of approximately 1,300 to 1,400 ft above mean sea level (msl), and its terminal drainage during the high-flow period of winter and spring is into the Cosumnes River, just

upstream of the Highway 99 crossing, in Sacramento County (Figure 7). During the low-flow, non-precipitation portion of the year (e.g., June through October), Deer Creek becomes intermittent downstream of Latrobe Road and thus does not have contiguous, flowing surface water continuity throughout its length. Consequently, Deer Creek typically does not discharge into the Cosumnes River during this period of the year. This period of intermittent flow and discontinuity with the Cosumnes River typically begins in late spring/early summer and lasts into November and often December (see [Appendix G](#), Sloughouse flow data). Deer Creek was historically ephemeral, as shown by the historic U.S. Geological Survey flow data compiled for the Sloughouse gage ([Appendix G](#)).

Cameron Park Lake was built in the early 1950s. It is approximately 45 surface acres in size, with an average depth of about 7 ft and a maximum depth at the dam of approximately 20 ft. The lake spills over a wooden dam at the lake outlet, providing much of the flow to the upper reaches of Deer Creek, below this dam. (L. McBride, General Manager of the Cameron Park Community Services District, pers. comm., November 8, 2002; December 5, 2002).

Natural flow into Cameron Park Lake generally stops between May 15 and June 1 (SWRCB 1995). Overflow and leakage from the dam at Cameron Park Lake, springs and tributary inflows, and urban runoff supply the creek's water downstream of the dam during the non-precipitation period of the year (SWRCB 1995). Summer base flows, upstream of the DCWWTP, have been documented in the range of 0.16-0.28 mgd (0.25-0.43 cfs) (SWRCB 1995). Unlike higher elevation creeks that receive perennial water supplies from snow pack, Deer Creek's small, low-elevation watershed does not hold snow pack.

Precipitation and runoff sustain and often dominate flows in Deer Creek during wet weather. During large storm events, Deer Creek flows can increase four orders of magnitude over their summer/fall low-flow levels ([Appendix G](#)).

Instream flows in Deer Creek's upper reaches are presently augmented, relative to what they were historically, due to urban runoff and discharges from the DCWWTP. All SWRCB-registered water rights for diversion from Deer Creek exist downstream of the DCWWTP site. Several small water rights (maximum application for direct diversion ranging from 0.0008-0.035 cfs) exist in the reach of the creek extending about 5 miles downstream of the DCWWTP. The primary water rights on the creek (i.e., those having higher permitted diversion rates for agricultural irrigation) exist between the Sloughouse area and the confluence with the Cosumnes River. These are both riparian and appropriative rights, many of which date back to the first half of the 1900s. Hence, instream flows during the non-precipitation period of the year in the upper reaches of the creek are somewhat higher than they were historically. Because the creek is ephemeral, because downstream diversions are making use of the additional water added to the system in upstream reaches, and because long-term flow records are not available for the creek at any location, it is difficult to determine how the seasonal flow regime in the lower reach of the creek has changed over time.

The soils underlying the Deer Creek channel south of Sloughouse (Figure 8) act as a “sponge” in the fall when initial rain events begin to increase Deer Creek flows in the upper watershed. Substantial amounts of precipitation and upstream flow are required to saturate the Deer Creek channel throughout its length and subsequently result in hydraulic continuity with the Cosumnes River. For example, the first substantial rain event of the fall of 2002, which occurred November 8-12, 2002, delivered 4.0 inches of rain as measured at the Sly Park Lake Gage (see CDEC website). This initial fall rain event of 4 inches resulted in a mean daily flow of approximately 38 cfs, and a peak flow of 150 cfs on November 8, 2002 as measured at the DCWWTP’s R1 (upstream) gage. Nevertheless, this was not a sufficient amount of precipitation and resultant Deer Creek flow to cause Deer Creek to establish hydraulic continuity with the Cosumnes River. The creek never established flowing surface water at Wilton Road during or following this initial storm event, which is located approximately 30 miles downstream of the DCWWTP. Conversely, this storm event did result in the Cosumnes River re-establishing hydraulic continuity with the Mokelumne River for a period of time during and following the precipitation event.

Based on available information, Deer Creek hydraulic continuity with the Cosumnes River is not re-established in the fall/winter period of the year until a substantial amount of precipitation has occurred, thereby saturating the creek channel’s underlying soils to the south of Sloughouse, which are characterized by relatively high infiltration rates. The portion of the Deer Creek channel near the Wilton Road crossing is believed to be one of the last reaches of the creek to re-establish surface water flows during the fall/winter period when hydraulic continuity with the Cosumnes River becomes re-established, annually, due to precipitation and associated runoff.

The re-establishment of Deer Creek’s surface-flow hydraulic continuity with the Cosumnes River was monitored weekly at four sites (Scott Rd, Kiefer Rd, Meiss Rd, and Wilton Rd) in the fall/winter of 2002. Approximately 4 inches of precipitation occurred in the Deer Creek watershed during the period November 7-12, 2002. Following this storm event, surface water flows returned to the Kiefer Rd site, which had previously been dry, and surface flows or standing water had existed previous to the rain event at Scott Rd and Meiss Rd. However, the Wilton Rd site never re-established surface flows (i.e., the creek bed remained dry) both during and following the 4-inch November rain event. In fact, the Wilton Rd reach of the creek had not re-gained surface water flow as of mid-December 2002. Wilton Road is located approximately 5.8 miles upstream of Deer Creek’s confluence with the Cosumnes River, and is one of the last reaches of Deer Creek to re-gain hydraulic continuity based on field inspections of the creek conducted throughout the fall of 2002. This mid-November 2002 rain event caused the Cosumnes River to re-establish hydraulic continuity with the Mokelumne River for five days, during and immediately following the rain event, but then the river disconnected again. Because Deer Creek did not re-establish hydraulic continuity, there was little to no discharge from Deer Creek into the Cosumnes River during or immediately following this substantial November precipitation event. On December 16, 2002 at approximately 6:00 P.M. surface flow continuity was established in Deer Creek

at the Wilton Road crossing. This was based on monitoring the Sacramento County automated staff gauge at the site. The surface flow continuity was confirmed by staff from RBI on December 17, 2002 at 9:30 A.M. Cumulative precipitation in the Deer Creek Watershed between October 1, 2002 and December 16, 2002 was 10.44 inches recorded at the Sly Park gage (upper watershed) and 5.2 inches at the Cosumnes River Eagles Nest Road gauge (lower watershed).

In addition to the 2002 field investigations that documented the above, an interview was conducted with a fourth-generation rancher, Mr. Robert Mahon, regarding his historic observations of Deer Creek flows in the fall/early winter. Mr. Mahon's ranch is located about one mile upstream of the confluence of Deer Creek with the Cosumnes River. He stated that there is almost never water flowing in Deer Creek, in the reach on his property, during October and November when the fall-run chinook salmon spawning run is occurring on the Cosumnes River. He stated that a lot of rain is required before this section of Deer Creek flows, which initially occurs in most years sometime in December. Mr. Mahon is 57 years old and has lived on this ranch his whole life (R. Mahon, pers. comm., December 12, 2002).

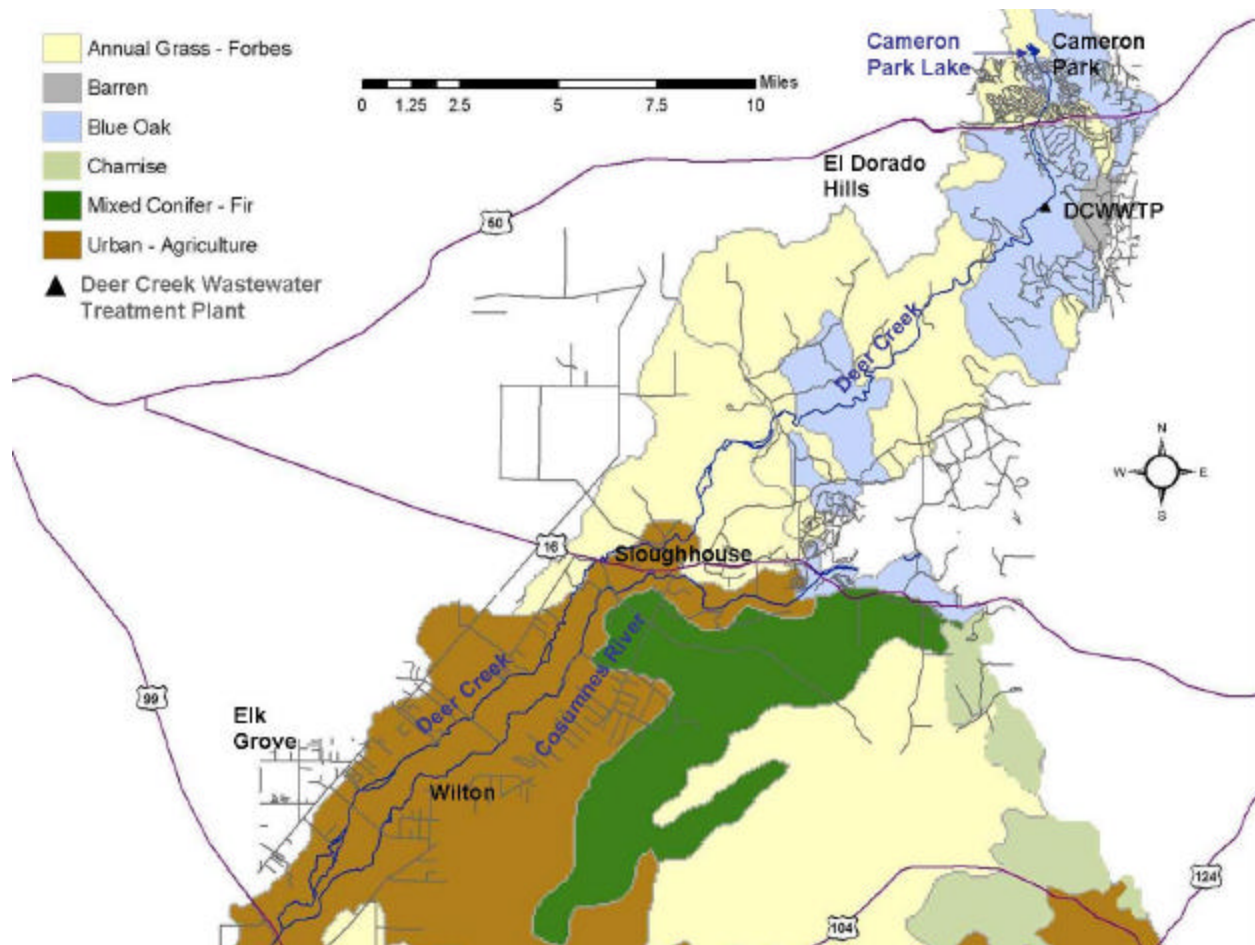


Figure 7. Land uses within the Deer Creek watershed

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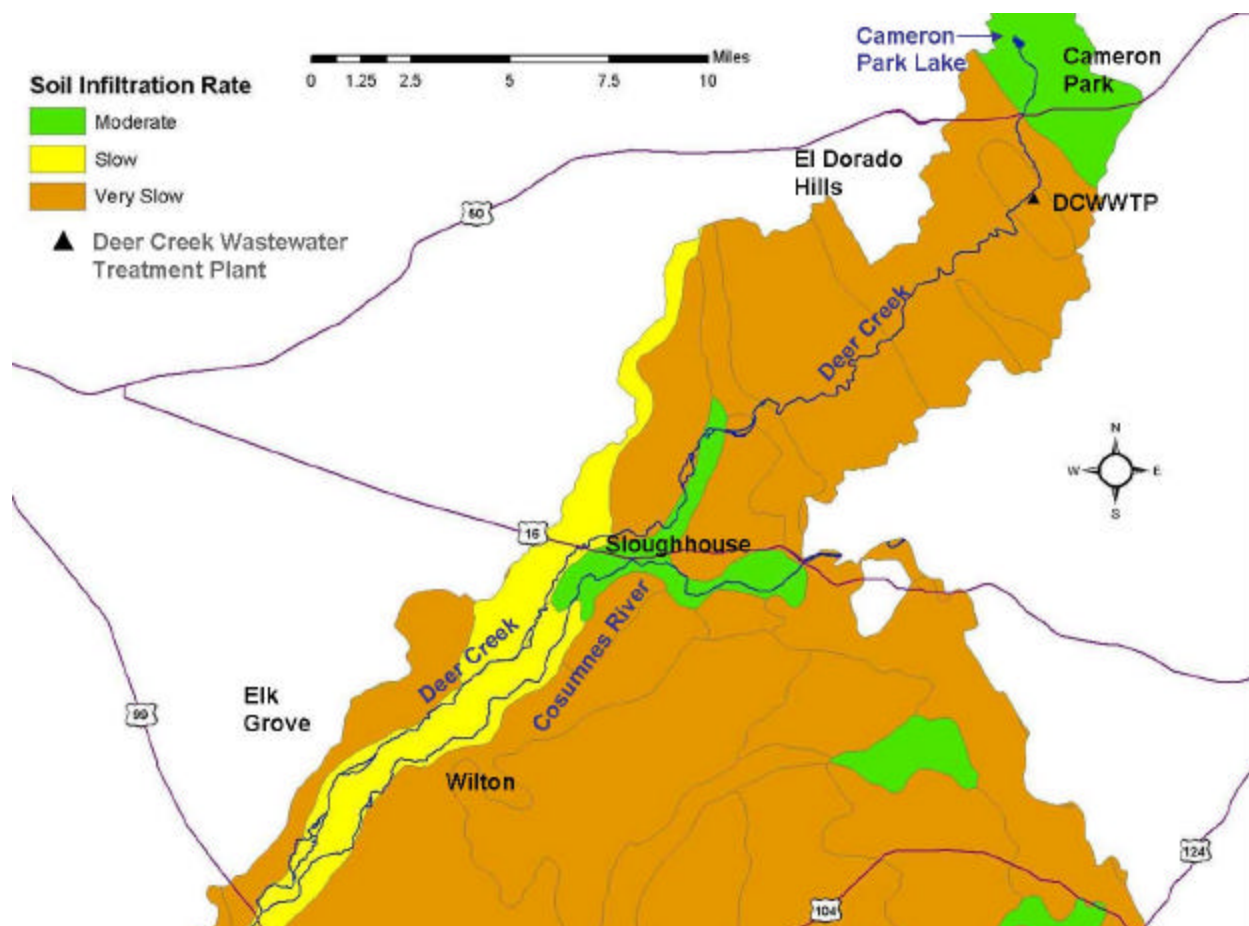


Figure 8. Soil types within the Deer Creek watershed

4.7.2.3 *Water Quality Conditions that could be Reasonably Achieved*

This section addresses the temperature conditions that could be reasonably achieved in Deer Creek under past, present, and future conditions. The primary location assessed is the R2 (immediate downstream) water quality monitoring station at the site of the DCWWTP. This site was selected because it accounts for thermal loading to the creek from the DCWWTP. No other regulated, point-source discharges potentially affecting Deer Creek temperature are known to occur on the creek.

In the assessment performed, the proposed site-specific temperature objectives were compared to Deer Creek temperatures that have occurred, or would be expected to occur, under the following four DCWWTP discharge conditions: 1) pre-discharge (as represented by historical R1 (upstream) temperature data; 2) current-level discharge; 3) permitted discharge (i.e., 2.5 mgd ADWF); and 4) a “worst-case” potential buildout scenario (i.e., 10.8 mgd ADWF). The data used for this analysis are the hourly temperature monitoring data collected by the District from September 9, 1997 through

November 29, 2000. The “pre-discharge” condition is represented by historical R1 (upstream) temperature data because no measured R2 temperature data are available prior to 1974, when the DCWWTP began discharging to Deer Creek. The “current discharge” condition is represented by the historical temperature data for the period cited above. The “permitted discharge” and “buildout discharge” conditions were developed by applying factors to the historical data set to simulate increased discharge levels corresponding to 2.5 mgd ADWF (i.e., discharge at the permitted capacity) and 10.8 mgd ADWF (a potential buildout condition). Separate analyses were performed for daily high and mean monthly temperatures, which are presented separately below.

4.7.2.3.1 Daily Maximum Temperature Conditions

Figure 9 and **Figure 10** compare the proposed daily high temperature objectives to the daily maximum temperatures calculated (via mass-balance equations) for the four discharge conditions defined above, under 1997-2000 ambient hydrology/weather conditions. These comparisons demonstrate that existing facilities and operations of DCWWTP currently facilitate compliance with the proposed daily high temperature objectives at the R2 location, and would be expected to continue to do so under all potential future discharge scenarios. Calculations show that daily high temperatures under the three DCWWTP discharge conditions evaluated (i.e., current discharge, permitted capacity, and potential buildout) would never exceed the applicable proposed daily maximum temperature objective. Conversely, the pre-discharge condition is shown to periodically exceed the proposed daily high objectives during the summer months. These results indicate that effluent discharges can have a moderating effect on Deer Creek’s daily maximum temperatures during summer months of the year.

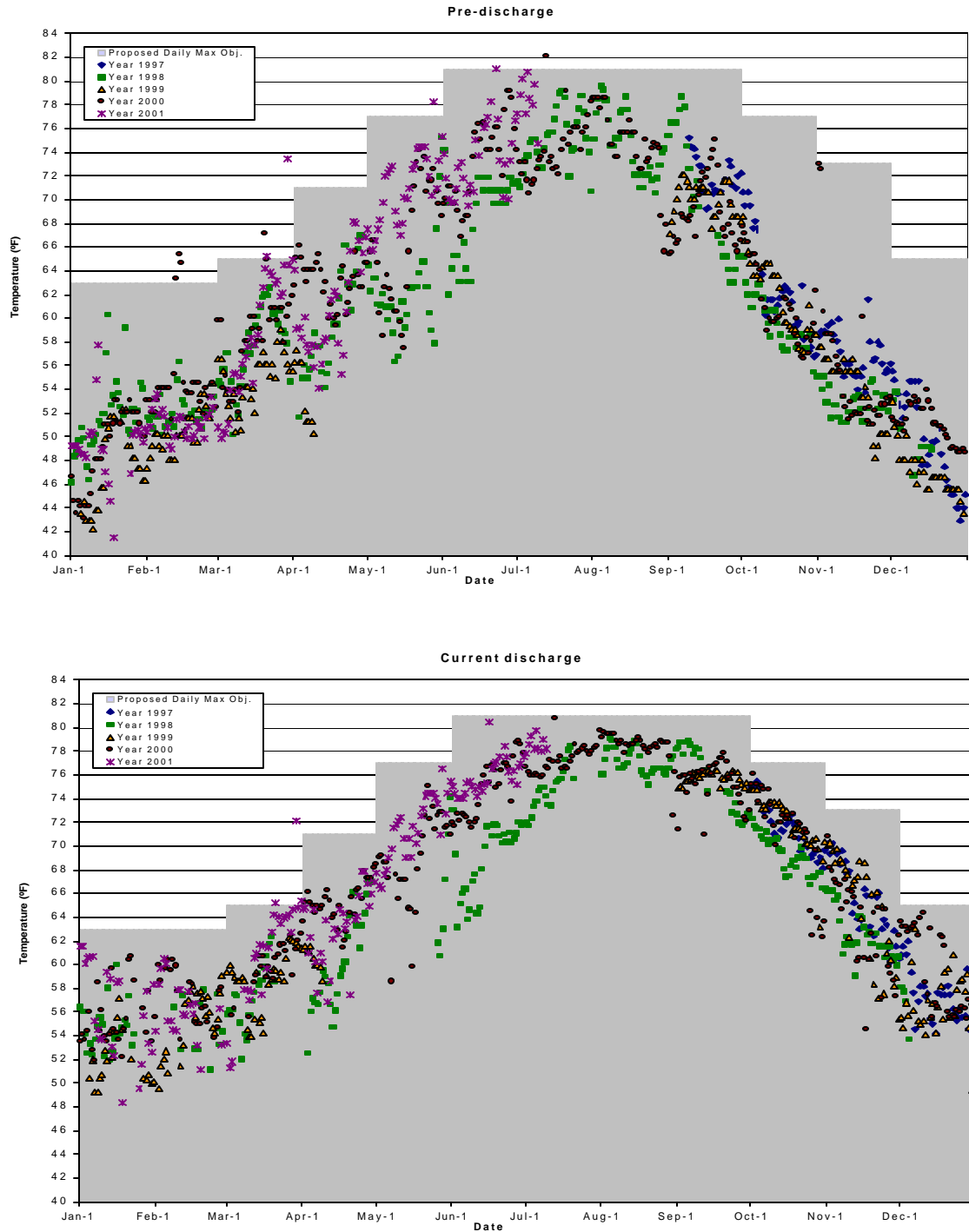


Figure 9. Comparison of the proposed daily high temperature objectives to calculated Deer Creek daily high temperatures at the R2 (downstream) monitoring location under two future DCWWTP discharge conditions: 1) pre-discharge; and 2) current discharge, and ambient hydrologic/weather conditions that occurred during the period 1997-2001. Plotted values are derived from the District's hourly data set via mass-balance calculations using measured R1 and effluent temperatures and flows for the months for which these data were available between September 9, 1997 and July 9, 2001.

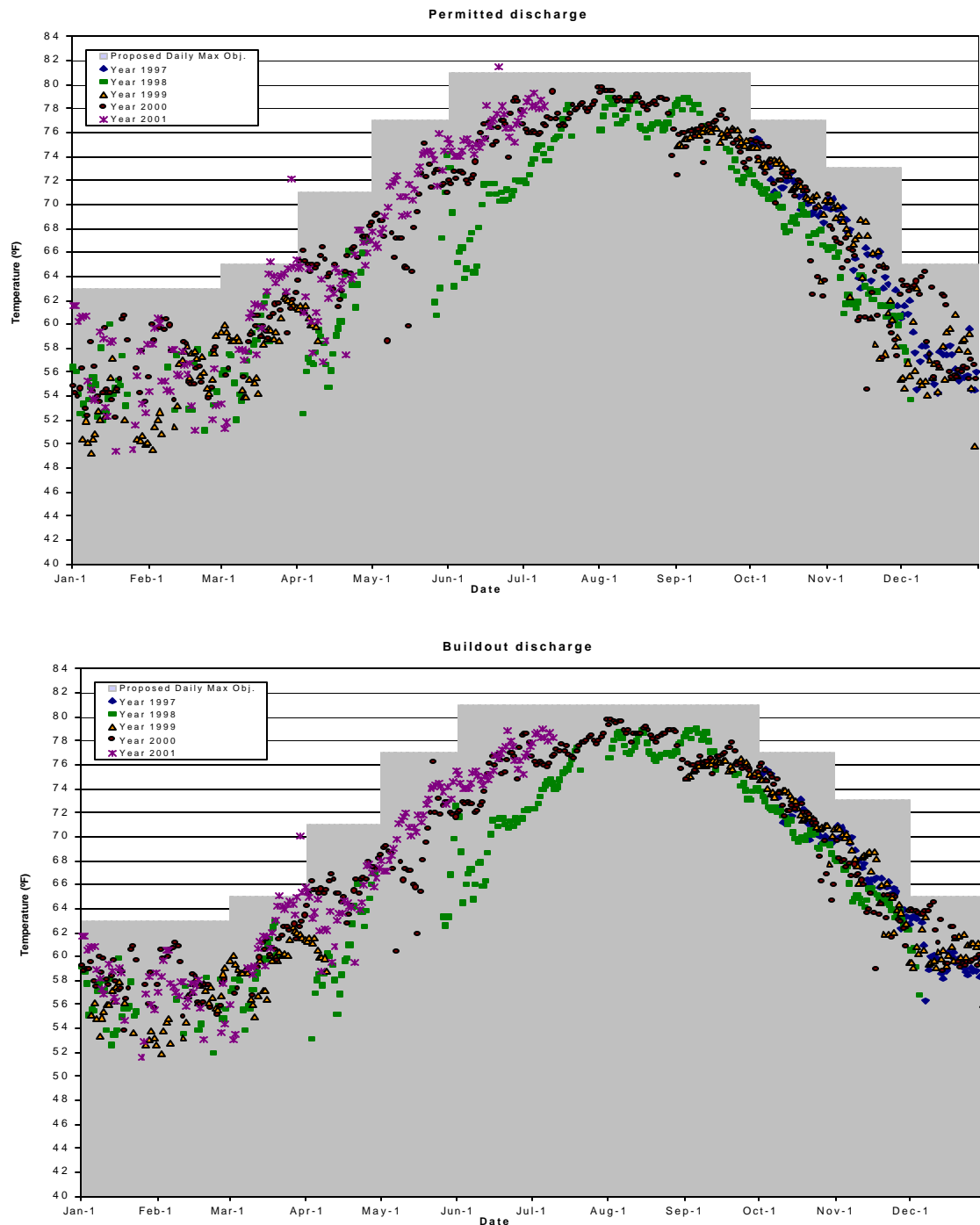


Figure 10. Comparison of the proposed daily high temperature objectives to calculated Deer Creek daily high temperatures at the R2 (downstream) monitoring location under two future DCWWTP discharge conditions: 1) permitted discharge (2.5 mgd ADWF); and 2) potential buildout (10.8 mgd ADWF), and ambient hydrologic/weather conditions that occurred during the period 1997-2001. Plotted values are derived from the District's hourly data set via mass-balance calculations using measured R1 and effluent temperatures and flows for the months for which these data were available between September 9, 1997 and July 9, 2001.

4.7.2.3.2 Monthly Average Temperature Conditions

Figure 11 and **Figure 12** compare the proposed monthly average temperature objectives to the monthly average temperatures calculated for the four discharge conditions defined above, under 1997-2000 ambient hydrology/weather conditions. These comparisons demonstrate that current facilities and operations of DCWWTP would comply with the proposed monthly average temperature objectives at the R2 location under current-level and permitted-level discharge. Moreover, if under a potential buildout condition (e.g., 10.8 mgd ADWF) the creek were to exceed proposed monthly average temperature objectives, such as calculated for November 1997, August 2000, and May-July 2001 conditions, then temperature control measures would be implemented when the DCWWTP is expanded to this capacity and monitoring demonstrates exceedances. Modifications to DCWWTP facilities/operations that could potentially be implemented to control thermal loading to the creek in the future, should it be necessary, include the following:

- 1) construction and seasonal operation of cooling towers or other cooling devices, and associated facilities, to cool the effluent discharged to the creek; and/or
- 2) seasonal pumping of upstream limestone quarry water into Deer Creek to offset thermal loading from DCWWTP discharges.

In addition to the above measures, the District could simply elect to limit future expansion of the DCWWTP discharge to some level of ADWF capacity below the theoretical 10.8 mgd (ADWF) that was used for the purposes of this assessment.

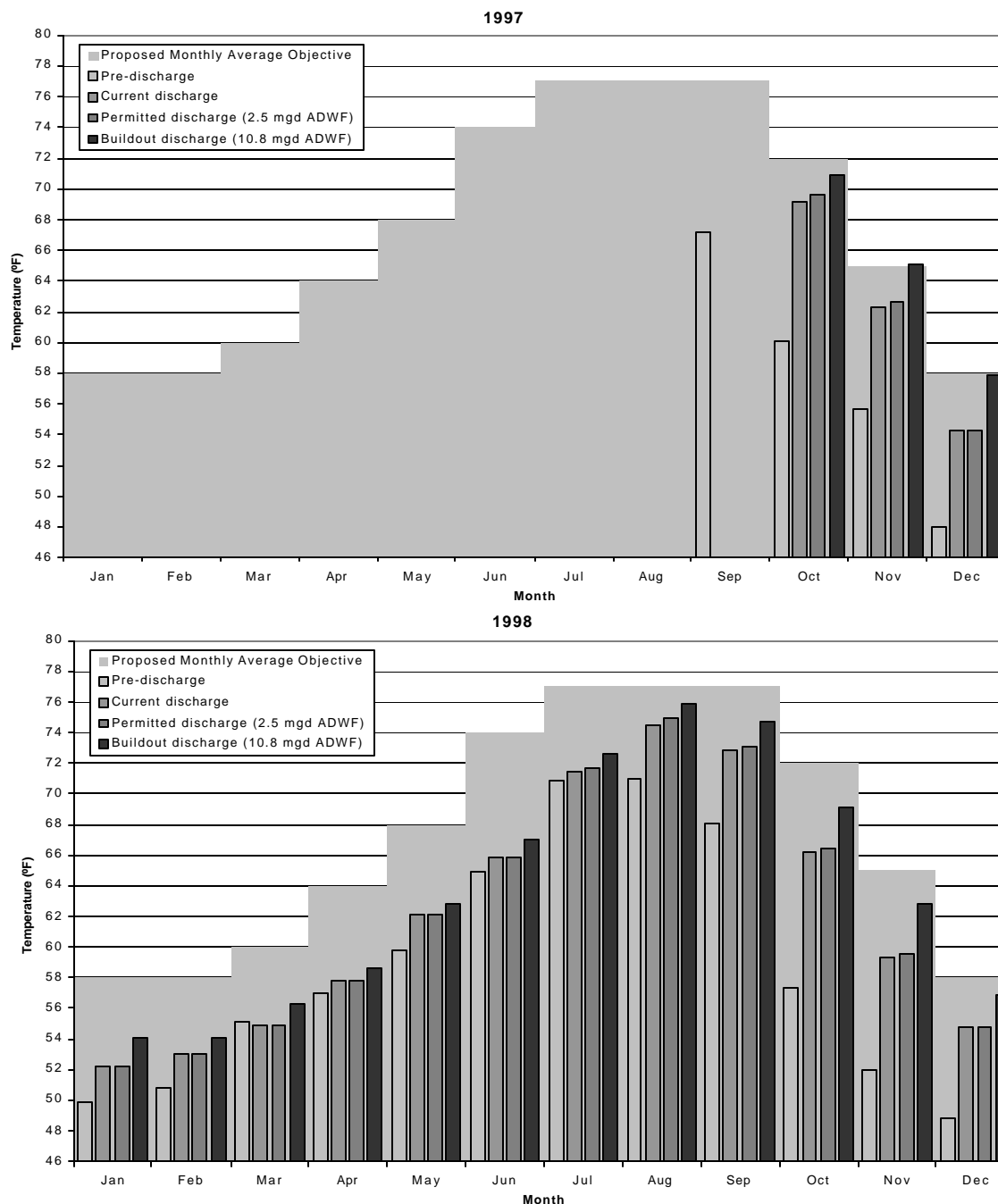


Figure 11. Comparison of the proposed monthly average temperature objectives to calculated monthly average Deer Creek temperatures at the R2 (downstream) monitoring location under four DCWWTP discharge conditions: 1) pre-discharge; 2) current discharge; 3) permitted discharge; and 4) buildout, and ambient hydrologic/weather conditions that occurred in 1997 and 1998. Plotted values are derived from the District's hourly data set via mass-balance calculations using measured R1 and effluent temperatures and flows for the months for which these data were available.

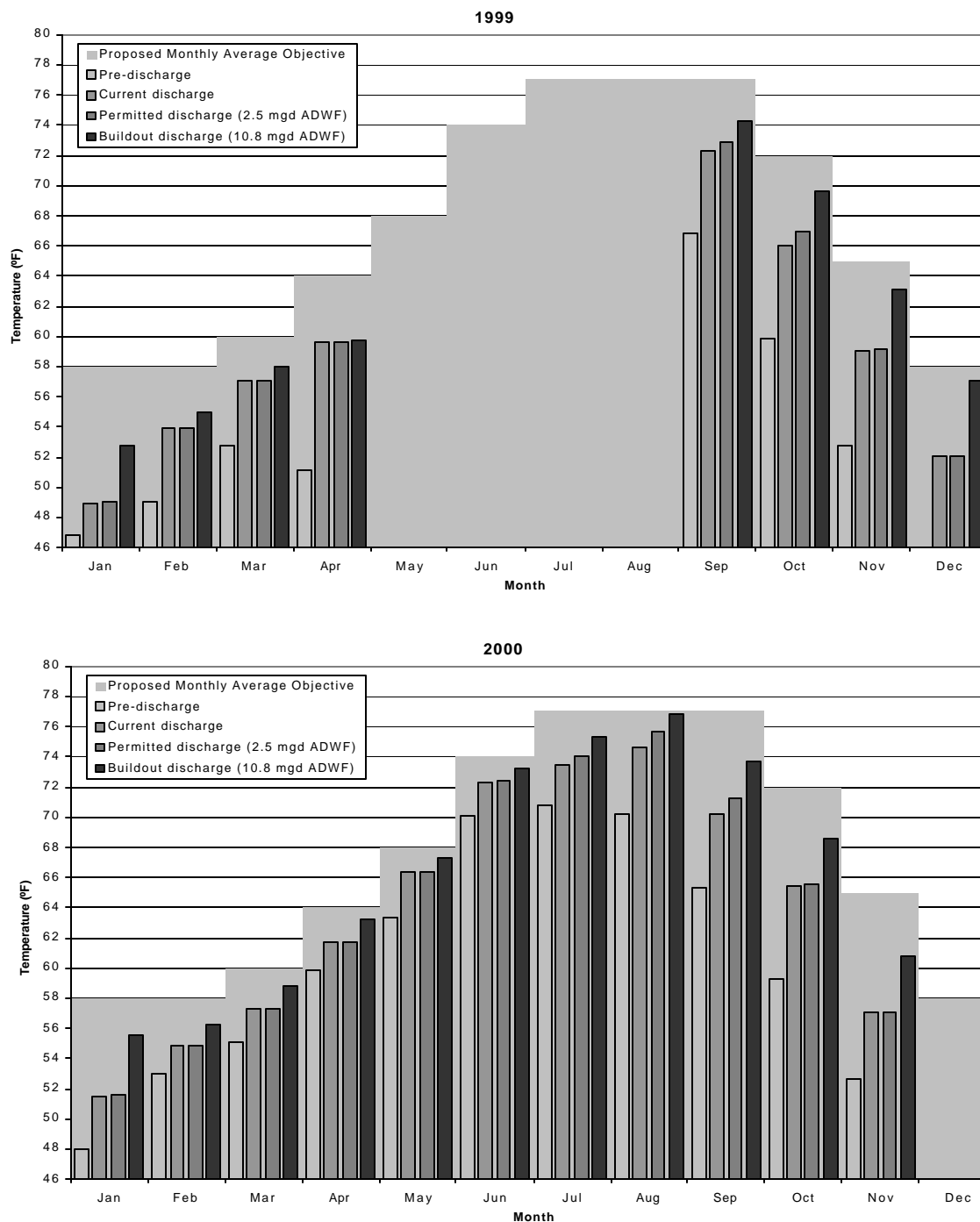


Figure 12. Comparison of the proposed mean monthly temperature objectives to calculated mean monthly Deer Creek temperatures at the R2 (downstream) monitoring location under four DCWWTP discharge conditions: 1) pre-discharge; 2) current-level discharge; 3) permitted discharge; and 4) buildout, and ambient hydrologic/weather conditions that occurred in 1999 and 2000. Plotted values are derived from the District's hourly data set via mass-balance calculations using measured R1 and effluent temperatures and flows for the months for which these data were available.

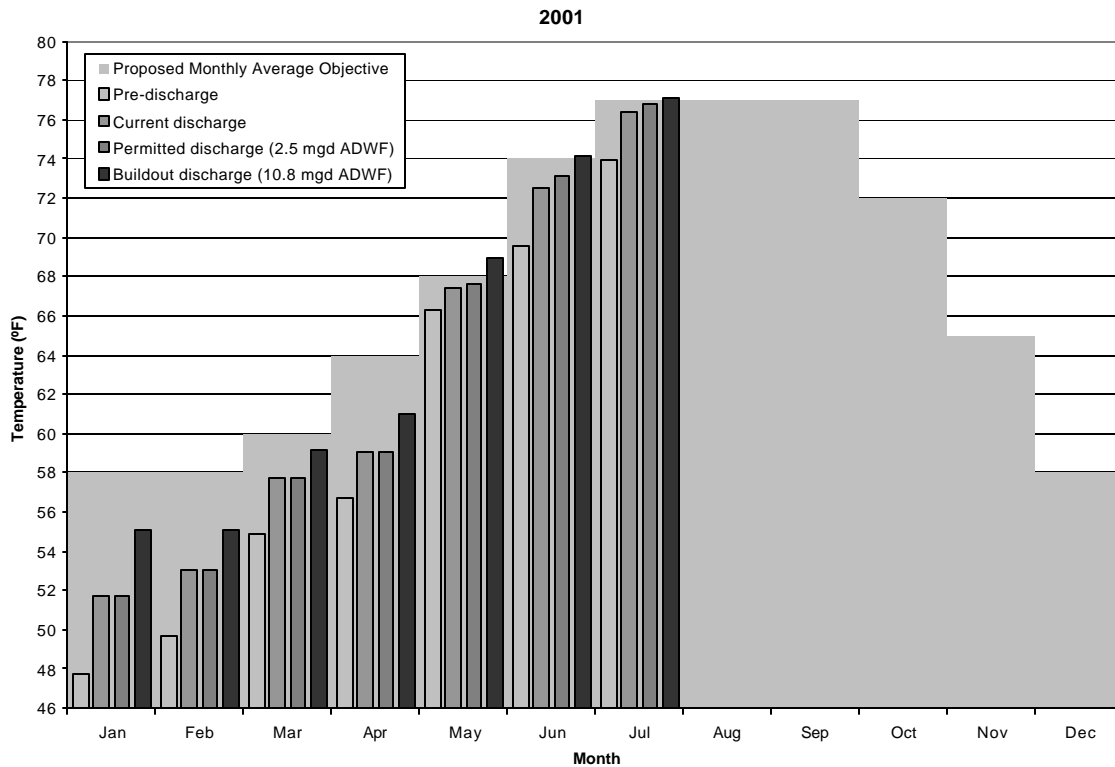


Figure 13. Comparison of the proposed mean monthly temperature objectives to calculated mean monthly Deer Creek temperatures at the R2 (downstream) monitoring location under four DCWWTP discharge conditions: 1) pre-discharge; 2) current-level discharge; 3) permitted discharge; and 4) buildout, and ambient hydrologic/weather conditions that occurred in 2001. Plotted values are derived from the District's hourly data set via mass-balance calculations using measured R1 and effluent temperatures and flows for the months for which these data were available.

Economic Considerations

As stated in the previous section, current facilities and operations of the DCWWTP would facilitate consistent compliance with the proposed set of temperature objectives under existing hydrologic conditions. Therefore, no economic effects are expected to be incurred by the District or any other parties as a result of adopting the proposed set of temperature objectives for Deer Creek.

4.7.2.4 Need for Housing

If adopted, the proposed set of site-specific temperature objectives would not adversely impact the need for, or ability to develop, housing in the Deer Creek watershed.

4.7.2.5 Need to Develop and Use Recycled Water

If adopted, the proposed set of site-specific temperature objectives would not adversely impact the ability to develop and use recycled water in the Deer Creek watershed.

5 ANTIDEGRADATION ANALYSIS

Both the U.S. EPA (40 CFR 131.12) and the State (State Board Resolution No. 68-16) have adopted antidegradation policies. The Regional Board must assure that its actions do not violate the federal and State antidegradation policies. This section of the Staff Report analyzes whether approval of the site-specific temperature objectives proposed for Deer Creek would be consistent with the federal and State antidegradation policies.

5.1 FEDERAL ANTIDEGRADATION POLICY

The federal antidegradation policy provides, in part (40 CFR 131.12):

“(1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

(2) Where the quality of waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State’s continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located...

(3) Where high quality waters constitute an outstanding National resource, such as waters of National and States parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.”

5.2 STATE ANTIDEGRADATION POLICY

Antidegradation provisions of State Board Resolution No. 68-16 ("Statement of Policy With Respect to Maintaining High Quality Waters in California") state, in part:

“1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water

quality consistent with maximum benefit to the people of the State will be maintained.”

5.3 ANTIDEGRADATION ANALYSIS OF THE PROPOSED TEMPERATURE OBJECTIVES FOR DEER CREEK

The proposed seasonal, site-specific temperature objectives would not result in a degradation of Deer Creek water quality, with respect to temperature currently achieved or provided for in this water body or those that would be achieved under the current Basin Plan temperature objective. This analysis compares: 1) the proposed site-specific objectives to the current Basin Plan “delta 5°F” temperature objective; 2) creek temperatures likely to occur under the proposed vs. current objectives; and 3) the degree of beneficial use protection provided by the proposed vs. current objectives. The primary location used for comparison is the R2 (immediate downstream) water quality monitoring station at the site of the DCWWTP. Other creek locations also are addressed.

5.3.1 Proposed vs. Current Objectives

This section compares the proposed, site-specific Deer Creek temperature objectives to the Basin Plan’s current “delta 5°F” objective, thereby addressing creek temperatures that would be allowed under each objective. Because the proposed objective has both daily high and monthly average components, comparison to the current Basin Plan objective is made on both a daily high (**Figure 14** and **Figure 15**) and a monthly average basis (**Figure 17**). The data used for this analysis are the hourly temperature monitoring data collected by the District during the period September 9, 1997 to November 29, 2000. Gaps in the data presented in the graphs below indicate that data were not available for that period.

During the months of October, November, and December, the proposed daily high temperature objectives would be less restrictive than the Basin Plan’s current delta 5°F objective. Based on R1 (upstream) creek temperatures that occurred in one or more years of the 4 years for which data are available, the proposed daily high temperature objectives for the winter/spring period January through May are, on a long-term basis, similarly restrictive to that of the current delta 5°F objective. During the June through September summer period, the proposed daily high objectives are similarly restrictive or more restrictive than the current Basin Plan’s delta 5°F objective (Figure 14 and Figure 15). Similar seasonal relationships between the proposed and current temperature objectives occur on a monthly average basis (Figure 17).

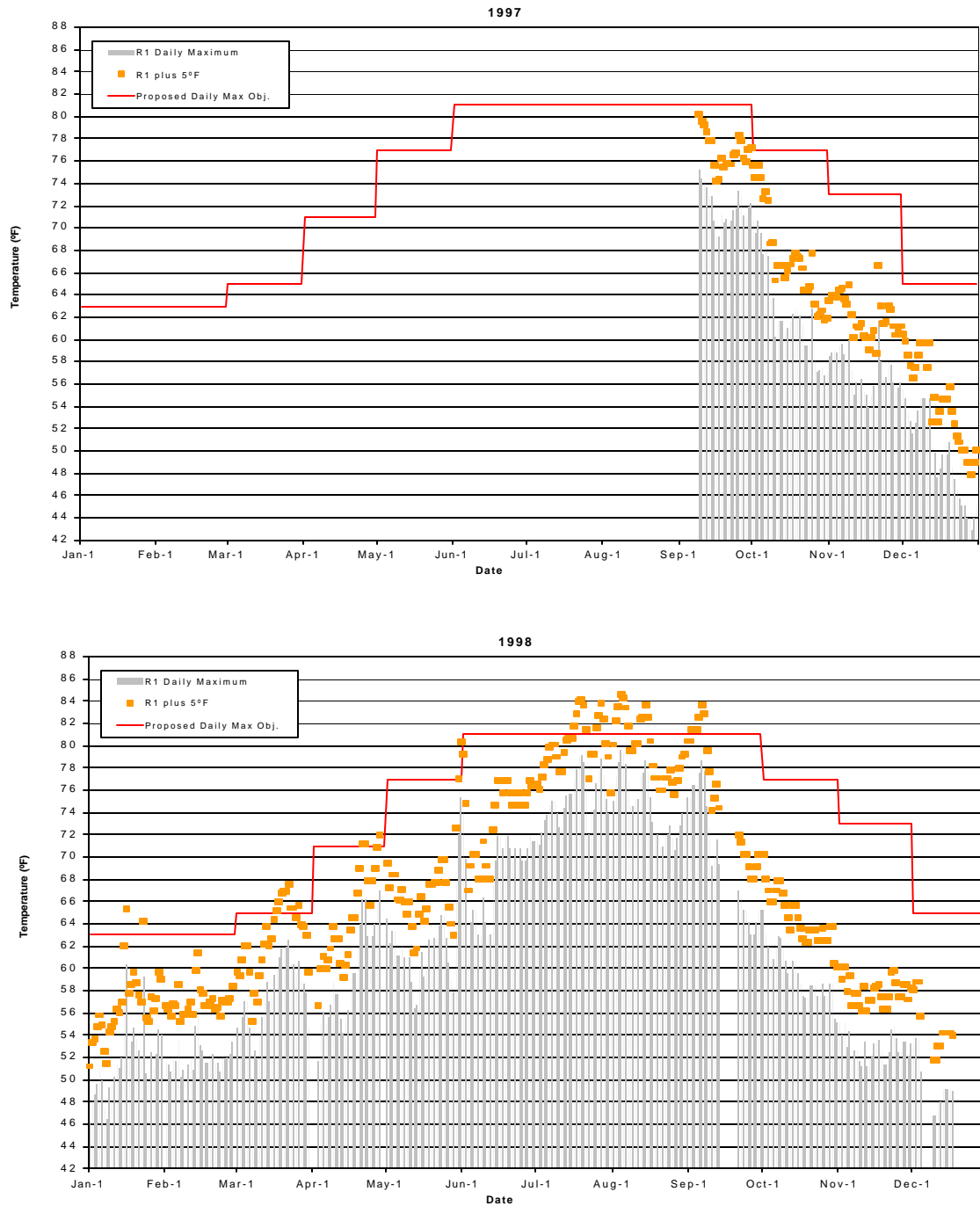


Figure 14. Comparison of the proposed site-specific, seasonal, daily high temperature objectives to the current Basin Plan temperature objective. Current Basin Plan objective is depicted as the daily high R1 (upstream temperature) plus 5°F. Plotted values represent all available data from the District's hourly data set for the years 1997 and 1998.

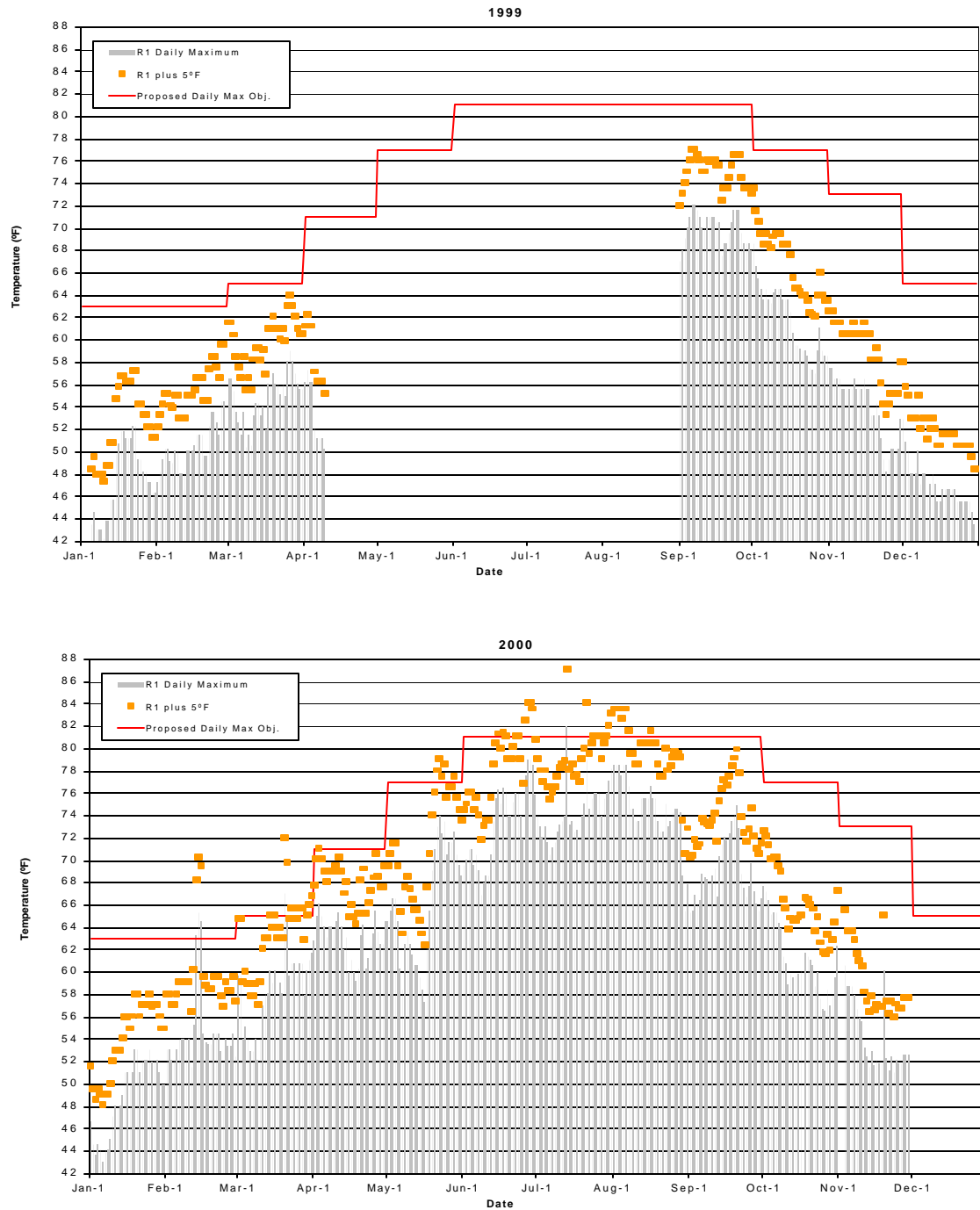


Figure 15. Comparison of the proposed site-specific, seasonal, daily high temperature objectives to the current Basin Plan temperature objective. Current Basin Plan objective is depicted as the daily high R1 (upstream temperature) plus 5°F. Plotted values represent all available data from the District's hourly data set for the years 1999 and 2000.

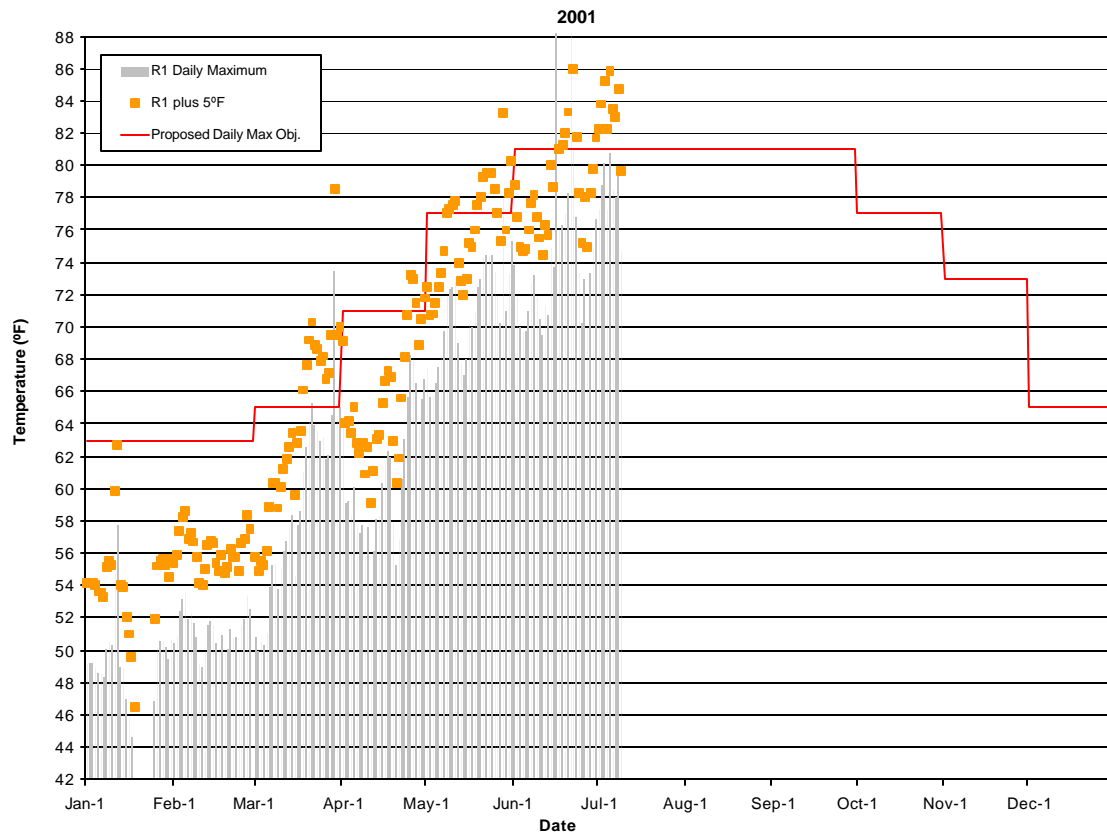


Figure 16. **Comparison of the proposed site-specific, seasonal, daily high temperature objectives to the current Basin Plan temperature objective. Current Basin Plan objective is depicted as the daily high R1 (upstream temperature) plus 5°F. Plotted values represent all available data from the District's hourly data set for the year 2001.**

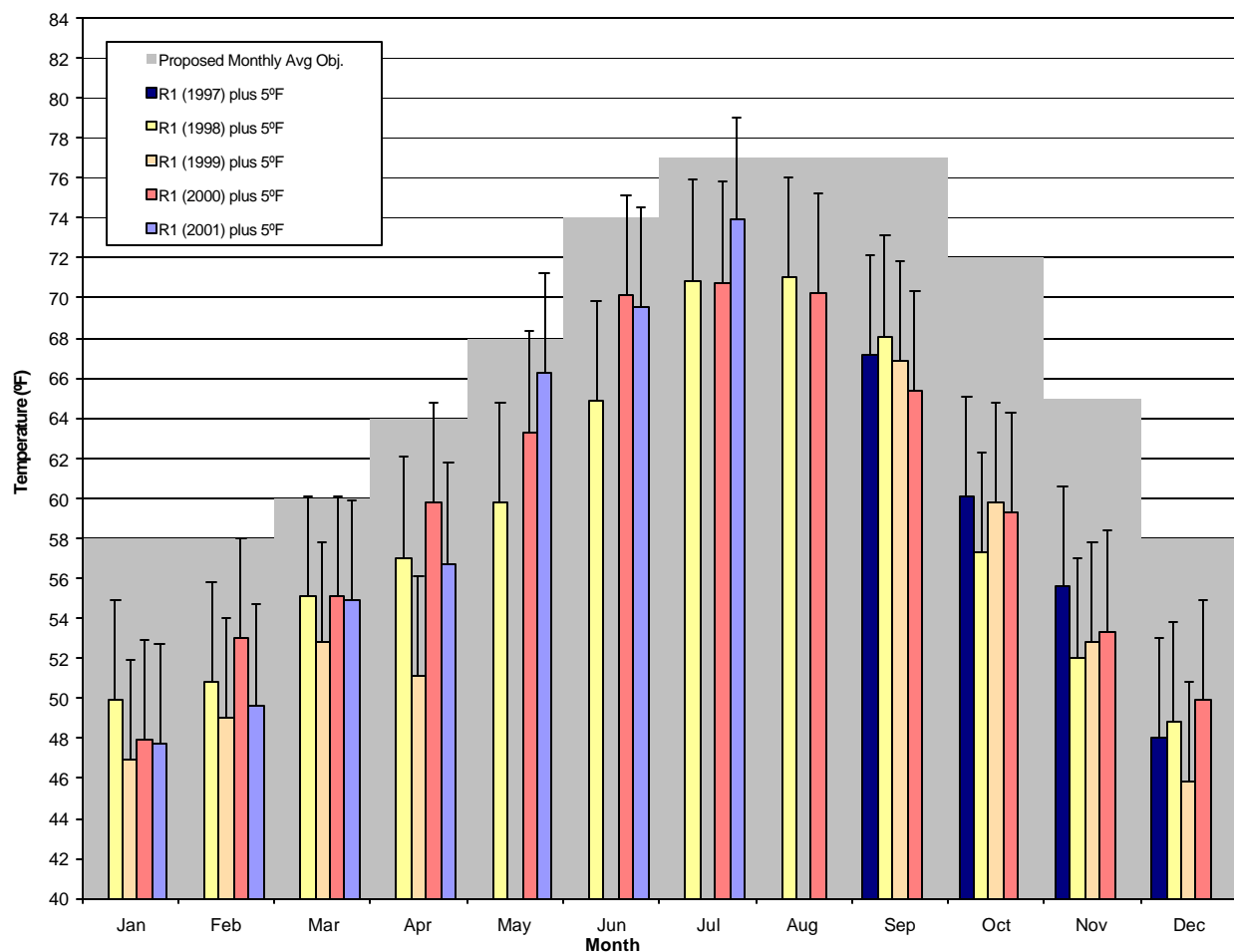


Figure 17. **Comparison of the proposed site-specific, seasonal, monthly average temperature objectives to the current Basin Plan temperature objective. Current Basin Plan objective is depicted as the monthly average R1 (upstream temperature that occurred, as depicted by bar height) plus 5°F (top of line above bar). Plotted values are from the District's hourly data set for the period September 9, 1997 to July 9, 2001.**

As illustrated by the graphs, the proposed objectives are, on the average, similarly restrictive or more restrictive than the current Basin Plan objective for 8 months of the year (January through August), and are less restrictive during 4 months (September through December) of the year. Because the DCWWTP is the only point-source discharge to Deer Creek regulated by the Basin Plan's current delta 5°F temperature objective, no other creek locations are discussed.

5.3.2 Creek Temperatures Likely to Occur under the Proposed vs. Current Objective

The proposed site-specific, seasonal objectives would not affect temperatures occurring in Deer Creek upstream of the DCWWTP. Downstream temperatures likely to occur in the creek under the proposed vs. current Basin Plan objectives are discussed below.

As shown by Figure 14 through Figure 17, temperatures occurring in Deer Creek immediately downstream of the DCWWTP (i.e., at the R2 site) during the 9-month January through September period of the year would consistently comply with both the proposed and current temperature objectives. Situations would rarely occur during these months when creek temperatures at the R2 location would comply with the proposed objectives, but not the current delta 5°F objective. Thus, the realized temperatures in the creek below the point of discharge (i.e., at R2) would typically be identical under the proposed and current objectives during the January through August period, and through September in some years.

Creek temperatures downstream of the DCWWTP would typically be warmer under the proposed objectives compared to downstream creek temperatures under the current Basin Plan objective from September through December. However, as discussed below, no adverse effects on Deer Creek beneficial uses are anticipated from the warmer September through December temperatures under the proposed objectives.

5.3.3 Beneficial Use Protection under the Proposed vs. Current Objective

The proposed temperature objectives would maintain absolute temperatures, on both a short-term (acute) and long-term (chronic) basis, that would protect and maintain the creek's existing aquatic life and other beneficial uses (see section 4.7.2 for a detailed discussion). The creek's beneficial uses most affected by water temperatures are the aquatic life uses. Regional Board, CDFG, NMFS, and the District's consultant cooperatively developed the proposed seasonal temperature objectives to protect and maintain Deer Creek's existing and probable future beneficial uses, with an emphasis on protecting the creek's aquatic life uses (see Section 4.7 for a detailed discussion of the scientific basis for objective development).

The current Basin Plan temperature objective limits the increase in natural receiving water temperature to 5°F. However, it is primarily the *absolute* temperatures that occur in the creek, not the *change* in temperature relative to an upstream point, that affects aquatic life. In its 1972 water quality criteria, the U.S. EPA stated the following as part of the technical discussion presented regarding development of temperature criteria for the protection of aquatic life (USEPA 1973):

"Criteria for making recommendations for water temperature to protect desirable aquatic life cannot be simply a maximum allowed change from 'natural temperatures.' This is principally because a change of even one degree from an ambient temperature has varying significance for an organism, depending upon where the ambient level lies within the tolerance range [for that organism]."

The above statement remains consistent with U.S. EPA's current guidance on development of ambient water temperature criteria. The proposed site-specific temperature objectives were developed based on available scientific literature pertaining to thermal requirements of Deer Creek's aquatic life (Section 4.7.1.1), and information collected on the existing ecological health of the creek through site-specific biological surveys (Section 3.2.1.1).

Approval and implementation of the proposed site-specific temperature objectives would provide equivalent thermal protection to the creek's aquatic biota during the January through May (winter/spring) period of the year. During the June through August summer period, when creek temperatures reach seasonal highs annually, the proposed objectives would provide equivalent or greater thermal protection to Deer Creek's aquatic life compared to the current Basin Plan delta 5°F objective. This equivalent to greater level of protection extends into September in many years. Greater thermal protection would often be provided by the proposed objectives, on an acute or instantaneous basis, associated with daily high temperatures during the summer months (Figure 14 and Figure 15). The proposed objectives are less restrictive, on a monthly average basis, during the fall/early winter period of September through December. The objectives proposed for these months were developed based on: 1) thermal requirements of aquatic species and life stages using Deer Creek during these months; 2) temperatures that have occurred during these months historically that have, in part, defined the creek's existing aquatic communities; and 3) temperatures that would protect and maintain the potential for fall-run chinook salmon and steelhead to make opportunistic use of Deer Creek. By giving full technical consideration to these key factors, the proposed temperature objectives developed for the October-December period, though less restrictive than the current Basin Plan objective during these months, would not result in degradation of Deer Creek's aquatic communities.

The proposed fall objectives, although less restrictive than the current objective during the fall period, would be protective of the aquatic species using the creek during the fall period of the year (S. Lehr, CDFG Fisheries Biologist, pers. comm., October 20, 2000). Resident juvenile and adult organisms present during the fall are existing in a rearing/maintenance life stage. The winter and spring periods are of greater ecological importance to maintaining the creek's aquatic communities, relative to the fall period, because they constitute the reproduction and early life stage periods for many aquatic organisms. Summer also is a critical period with regards to temperature because annual high temperatures are reached at this time of year. Seasonal high temperatures that occur in Deer Creek largely dictate which species can over-summer and sustain viable, self-sustaining populations in the creek.

Based on the above, the following conclusions can be made.

- 1) *The temperature increases allowed in the fall under the proposed objectives occur when the creek's assimilative capacity for thermal loading, from an ecological perspective, is greatest.*

- 2) *Throughout the winter and spring periods, the proposed vs. current objectives are similar and thus creek temperatures would typically differ little between the two.*
- 3) *The proposed objectives would be more restrictive on thermal loading, compared to the current Basin Plan objective, during the summer months when the creek's assimilative capacity for temperature is believed to be low.*

Overall, the site-specific set of daily high and monthly average temperature objectives proposed would maintain and protect the creek's existing and probable future aquatic life uses (S. Lehr, CDFG Fisheries Biologist, pers. comm., October 20, 2000; K. Whitener, The Nature Conservancy, Project Ecologist, pers. comm., October 20, 2000). In addition, the proposed temperature objectives would be protective of the creek's other existing and probable future beneficial uses.

In summary, the existing instream beneficial uses of Deer Creek, and the level of water quality necessary to protect the existing uses would be maintained upon approval of the proposed temperature objectives. Second, the proposed objectives would alleviate the need for costly upgrades to the DCWWTP (see Section 9 of this Staff Report), which would not be expected to provide demonstrable benefits to the creek's aquatic ecology. Third, approval of this site-specific objective would not cause degradation of water quality in any downstream water bodies. Finally, the proposed site-specific temperature objectives for Deer Creek would not result in water quality less than that prescribed in State water quality policies. Based on these findings, and technical input/recommendations provided by the CDFG (see Appendix E), Regional Board staff believe that the proposed set of seasonal, site-specific temperature objectives for Deer Creek is protective of the creek's existing and probable future beneficial uses.

6 ENDANGERED SPECIES ACT CONSIDERATIONS

6.1 OVERVIEW AND BACKGROUND

The U.S. EPA has final approval authority for the site-specific Basin Plan amendments proposed herein. U.S. EPA's approval of new and revised state water quality standards is a federal action subject to the consultation requirements of Section 7(a)(2) of the ESA (65 FR 24647 (April 27, 2000)). Section 7(a)(2) of the ESA states that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in destruction or adverse modification of designated critical habitat. Although consultation under the ESA is U.S. EPA's obligation, the EPA and the states acknowledge that states can assist EPA in fulfilling EPA's ESA obligations and have a role in assuring that state standards adequately protect aquatic life and the environment, including threatened and endangered species (65 FR 24643).

This section of the Staff Report has been prepared to assist the U.S. EPA in meeting its obligations under Section 7(a)(2) of the ESA as part of its action to approve the proposed Deer Creek SSBPAs. To assist the U.S. EPA, Regional Board staff have informally consulted with both NMFS and the U.S. Fish and Wildlife Service (USFWS) regarding the proposed amendments, and have incorporated input from these agencies directly into the site-specific water quality objectives proposed for Deer Creek.

6.2 NMFS ESA CONSIDERATIONS

NMFS has regulatory jurisdiction over anadromous salmonids, and is the agency responsible for listing steelhead as threatened under the federal ESA. Central Valley steelhead was listed as a federally threatened species under the federal ESA (63 FR 13347 (March 19, 1998, effective May 18, 1998)). Subsequent to that listing, NMFS promulgated its Final Rule defining critical habitat for steelhead in the Central Valley of California "Evolutionary Significant Unit" (ESU) on February 16, 2000 (65 FR 7764). Deer Creek and the Cosumnes River are included in the critical habitat designated for Central Valley steelhead.

However, in promulgating the critical habitat designation, NMFS stated that the available information allowed it only to characterize "basin-level designations," and that it cannot yet "depict salmonid habitats in a consistent manner or at a fine geographic scale" (65 FR 7767). Consequently, although NMFS has stated its preference to identify critical habitat by designating specific areas accessible to the species within the range of hydrologic units within each ESU, the watershed-based description does not provide "the level of resolution to define the species' presence or absence in specific local creeks and streams" (65 FR 7767)

The proposed site-specific temperature objectives for Deer Creek were developed cooperatively by staff from the Regional Board, CDFG, NMFS, USFWS, and the District and the District's consultant. As part of this collaborative process, technical discussions were held with NMFS to assist NMFS and the U.S. EPA in assessing whether the Proposed Action is likely to have an adverse effect on the Central Valley steelhead or its critical habitat.

Steelhead spawn in the winter months (primarily January through March) when water temperatures are cold and in-stream flows are typically high. In addition, juvenile steelhead have been found to emigrate from systems when water temperatures rise above levels suitable for continued in-river rearing. NMFS staff have suggested that steelhead make opportunistic use of various water bodies within the Central Valley under very specific hydrologic and water temperature conditions (e.g., cold, high-flow conditions of winter and spring months). Although there is no evidence that steelhead currently make use of Deer Creek, there is the possibility, albeit unlikely, that adult steelhead could immigrate into Deer Creek under high-flow conditions during the spawning season, spawn, and have juvenile fish rear in the creek until water temperatures reached levels that trigger a behavioral response to emigrate from the creek in search of colder waters. As a general agency position, however, NMFS has concluded that "[f]ew if any effects would result from an activity where it is well documented that the listed species makes little use of a river reach or basin and the existing habitat conditions are poor." (65 Fed. Reg. at 7767).

Following initial technical discussions among Regional Board, District, NMFS, and other agency staff, NMFS staff identified key considerations pertaining to steelhead and the Deer Creek SSBPA process. Specifically, NMFS staff indicated that this Staff Report should address why the proposed SSBPAs for Deer Creek would not:

- 1) result in "take," as defined under Section 9 of the ESA;
- 2) jeopardize the continued existence of the species and/or adversely modify designated Critical habitat; or
- 3) eliminate the potential for steelhead to opportunistically use Deer Creek and the Cosumnes River under certain hydrologic and water temperature conditions.

The three considerations identified by NMFS are addressed below. It should be noted that these three considerations are interrelated. NMFS has stated, "actions satisfying the standard for adverse modification are nearly always found to also jeopardize the species concerned, and the existence of a critical habitat designation does not materially affect the outcome of the section 7 consultation." (65 FR 7771-72) According to NMFS, the threshold to find "adverse modification" is not lower than the threshold necessary to find "jeopardy" (65 FR 7772).

In addition, NMFS' third point, with regard to protection of opportunistic use, was identified by NMFS as a specific management objective relevant to the issues it raised

concerning the ESA (see 65 Fed. Reg. at 7776 regarding special management considerations).

6.2.1 Site-specific Water Body Survey and Assessment

Site-specific water body surveys and assessments have been conducted for Deer Creek. The technical information provided by these surveys and assessments provides the technical information upon which decisions regarding existing and attainable beneficial uses of Deer Creek and appropriate water quality objectives are made. The data used as the technical basis for developing site-specific temperature objectives for Deer Creek are provided in Volume II, Section 3 of this Staff Report.

In addition, the following site-specific facts have been documented for the Cosumnes River.

- 1) Deer Creek is an intermittent stream during parts of the year upstream from the Cosumnes River (CDFG 1994b; SWRCB 1995; SWRI 1996;).
- 2) The Cosumnes River supports a population of fall-run chinook salmon, but lacks an annual run of steelhead (K. Whitener, The Nature Conservancy, pers. comm., April 24, 2000; B. Reavis, former CDFG District Fishery Biologist responsible for the Cosumnes River and Deer Creek, pers. comm., July 13, 1999).
- 3) Water temperatures in the Cosumnes River, at Wilton Road, can exceed 80°F for extended periods of time during the summer period of the year (K. Whitener, The Nature Conservancy, pers. comm., April 24, 2000).

6.2.2 Existing and Post-Action Conditions of Deer Creek and the Cosumnes River

Existing conditions of Deer Creek, including temperature conditions, support healthy and diverse aquatic communities both upstream and downstream of the DCWWTP (Staff Report, Volume II, Section 5.4.2; SWRI 1996; CDFG 1998). In April 1998, the CDFG's Aquatic Bioassessment Laboratory surveyed the benthic macroinvertebrates of Deer Creek using the California Stream Bioassessment Procedures (CSBP). In its survey report (CDFG 1998), CDFG stated that the WWTP effluent did not have a large effect on the biotic condition of Deer Creek downstream of the effluent discharge.

The site-specific temperature objectives developed for Deer Creek would be protective of Deer Creek's resident aquatic biota. Those objectives also would be protective of steelhead, in the event that this species would make opportunistic use of the creek.

Once the proposed site-specific amendments become effective, daily and seasonal levels for Deer Creek temperature and other water quality parameters would not be expected to change, relative to existing conditions. Facilities and operations, including the temperature of the discharge at the DCWWTP would not change, relative to existing conditions. Therefore, Deer Creek water quality downstream of the DCWWTP would not change as a result of the Proposed Action. Because the Proposed Action would not

cause a change in the water quality of Deer Creek, it would also not affect the water quality of the Cosumnes River to which Deer Creek is tributary.

Possible future expansion of the DCWWTP, to accommodate planned and approved growth in the region, could result in additional effluent discharges to Deer Creek. Expansion of the existing recycled water program could maintain current discharge levels to the creek in some months, even with an expanded plant. Future changes to downstream hydrology/water quality would primarily be dependent upon changes to current facilities and/or operations of the DCWWTP to accommodate planned and approved growth. Any possible future expansion(s) of the DCWWTP would undergo, to the extent required, separate CEQA environmental review, ESA consultation and NPDES permit approval.

6.2.3 NMFS Steelhead ESA Issues

NMFS staff indicated the issues for consideration under the ESA are whether U.S. EPA's approval of the proposed site-specific temperature objectives for Deer Creek would: 1) cause "take" of steelhead; 2) jeopardize the continued existence of the species or adversely modify critical habitat; or 3) reduce/eliminate the potential for steelhead to opportunistically use Deer Creek. These three issues are interdependent. Each of these issues is directly addressed below.

6.2.3.1 ESA Section 9 "Take"

Under the ESA, it is illegal to "take" a listed species without a permit or other authorization. 16 U.S.C. § 1538(a). There can be a "take" of a species through habitat modification only to the extent that such modification results in the actual killing or injury to a member of the species. *Babbitt v. Sweet Homes Chapter of Communities for a Greater Oregon*, 515 U.S. 687 (1995).

In a Deer Creek SSBPA technical meeting held in June 2000, NMFS staff indicated that the key issue regarding steelhead "take" (within the context of the Proposed Action) is to avoid operating the DCWWTP in a manner that would increase the potential for steelhead to opportunistically immigrate into and spawn in Deer Creek, only to have juvenile steelhead that were potentially produced "trapped" by rapid loss of surface flow continuity with downstream water bodies, and later lost due to high summer water temperatures. NMFS staff further stated that summer water temperatures that average about 68°F or higher have been shown to trigger juvenile steelhead to move in search of colder waters, ultimately leading to early emigration from systems where water temperatures are not conducive to rearing. For successful steelhead emigration from Deer Creek to occur, steelhead would have to emigrate when sufficient surface flow continuity with the Cosumnes River existed.

Deer Creek water temperatures, upstream of the DCWWTP discharge, naturally increase to mean daily values of 68°F or higher in June, with downstream water temperatures being even higher because creek temperatures increase with increasing distance downstream at this time of the year. Mean monthly upstream water temperatures reach about 71-73°F with daily high temperatures of 79-82°F by July.

Simultaneously, stream flows naturally become reduced throughout the non-precipitation period of the year with loss of contiguous surface water flow to the Cosumnes River (i.e., surface flow continuity) believed to generally occur in June/July. Any steelhead in the system would need to have emigrated by this time. Those that did not emigrate would have a no chance of surviving throughout the summer months, regardless of the plant's effects on creek temperatures.

The Proposed Action will not cause a change in the hydrology or water quality of Deer Creek, relative to existing conditions. Approval and implementation is not expected to cause or increase the risk for "take" of steelhead.

6.2.3.2 Jeopardy/Critical Habitat

In its Final Rule on critical habitat published in the Federal Register, and as stated above, NMFS stated the following with regard to steelhead:

"In streams where there is limited species distribution information, NMFS biologists would make their best professional judgment about the access to and suitability of available habitat and what if any impacts would occur to the listed fish as a result of a specific activity. Few if any effects would result from an activity where it is well documented that the listed species makes little use of a river reach or basin and the existing habitat conditions are poor" (65 FR at 7767).

All available evidence demonstrates that there will be no impacts to the steelhead as a result of the proposed action. This conclusion is based on three fundamental findings. First, steelhead have not been documented in Deer Creek. Second, the existing creek temperature conditions, for approximately half the year, are poor with regards to thermal requirements of steelhead, even upstream of the DCWWTP. Third, the Proposed Action would not cause a change in the hydrology or water quality of Deer Creek. Implementation of the Proposed Action would not be expected to jeopardize the continued existence of Central Valley steelhead, nor would it be expected to destroy or adversely affect critical habitat designated for the species.

6.2.3.3 Potential for Steelhead to Opportunistically Use Deer Creek and the Cosumnes River

Approval and implementation of the Proposed Action would not cause a change in the hydrology or water quality of Deer Creek. Therefore, the Proposed Action would not affect the potential for steelhead to opportunistically use Deer Creek.

6.3 USFWS ESA CONSIDERATIONS

The USFWS has regulatory jurisdiction over all species listed under the federal ESA other than anadromous salmonids, which fall under the jurisdiction of NMFS. U.S. EPA's approval of site-specific temperature objectives for Deer Creek would be a federal action subject to the requirements of ESA section 7, which requires federal agencies to ensure that their actions will not likely jeopardize the continued existence of

threatened or endangered species or result in the destruction or adverse modification of critical habitat. Even in the event that a listed plant, amphibian, reptile, or other species for which USFWS has jurisdiction were to use the creek and/or its riparian corridor, U.S. EPA's action of approving the proposed site-specific water quality objectives for Deer Creek would not be likely to adversely affect the species. This is because the proposed amendment would not change current creek hydrology and would not allow a future change in the creek's seasonal temperature regime, relative to existing conditions, of sufficient magnitude to adversely affect plant, amphibian, reptile, or other species utilizing the creek or its riparian corridor.

Possible future expansion of the DCWWTP could result in additional effluent discharges to Deer Creek. Expansion of the existing recycled water program could maintain current discharge levels to the creek in some months. Future changes to downstream hydrology/water quality would primarily be dependent upon changes to current facilities and/or operations of the DCWWTP. Any possible future expansion(s) of the DCWWTP would undergo, to the extent required, separate CEQA environmental review, ESA consultation and NPDES permit approval.

7 PROGRAMS FOR IMPLEMENTATION OF SITE-SPECIFIC OBJECTIVES

The Porter-Cologne Water Quality Control Act states that Basin Plans consist of beneficial uses, water quality objectives, and a program of implementation for achieving their water quality objectives (Water Code Section 13050(j)). Water Code Section 13242 prescribes the necessary contents of a program of implementation, which includes:

- 1) a description of the nature of the actions that are necessary to achieve the water quality objectives, including recommendations for appropriate action by any entity, public or private;
- 2) a time schedule for the actions to be taken; and
- 3) a description of surveillance to be undertaken to determine compliance with the objectives.

Each of these requirements is discussed separately below.

7.1 ACTIONS NECESSARY TO ACHIEVE THE PROPOSED WATER QUALITY OBJECTIVES

Deer Creek is effluent-dominated downstream of the DCWWTP during most of the low-flow period of the year (e.g., June through October, and part of November in most years). As stated in Chapter IV (Implementation) of the Basin Plan, municipal point source discharges to surface waters are generally controlled through NPDES permits. Although the NPDES program was established by the CWA (Section 402), the permits are prepared and enforced by the Regional Board per California's authority for the Act. Discharges to Deer Creek from DCWWTP are regulated under a NPDES permit issued by the Regional Board (currently Order No. R5-2002-0210, NPDES No. CA 0078662).

Upon the proposed set of site-specific temperature objectives for Deer Creek becoming effective, no specific actions would be necessary to achieve these objectives. Continued operation of the DCWWTP in a manner similar to current operations, and consistent with its applicable NPDES permit, would result in achievement of the proposed temperature objectives. The probability of exceeding the proposed objectives under current operations and hydrology is negligible. Temperature calculations show that the proposed temperature objectives can be consistently met downstream of the DCWWTP under existing and future conditions (Section 4.7.2.3, Figure 9 through Figure 12).

Achievement of the proposed objectives under possible future (e.g., 2030) buildout conditions could require modifications to current DCWWTP operations. These actions may be subject to separate CEQA analysis at the time these actions are proposed.

Because achievement of the site-specific temperature objectives proposed for Deer Creek would be accomplished through implementation of the Regional Board's current NPDES permitting program, a separate Program of Implementation need not be developed to achieve the proposed site-specific temperature objectives.

7.2 TIME SCHEDULE FOR COMPLIANCE

Because compliance with the proposed site-specific objectives for Deer Creek temperature presently occurs, and is expected to continue to occur in the future, no schedule for compliance with the proposed site-specific water quality objectives needs to be developed.

7.3 MONITORING AND SURVEILLANCE PROGRAM

To comply with Water Code Section 13242, a Monitoring and Surveillance Program will be implemented at the time the proposed Basin Plan amendments become effective. For additional detail about this Program, see Section 8 of this Staff Report.

8 MONITORING AND SURVEILLANCE PROGRAM

This section contains a description of the monitoring and surveillance activities to be undertaken by the Regional Board and the District. Monitoring and surveillance includes monitoring by the District, monitoring and investigations by the Regional Board, and surveillance and inspections by the Regional Board. Acquisition of data is a basic need of a water quality control program, and is required by both the federal CWA and the Porter-Cologne Water Quality Control Act.

8.1 PROPOSED ACTIVITIES

8.1.1 Discharger Monitoring

8.1.1.1 Water Quality Monitoring

The District operates the DCWWTP under Regional Board Order No. R5-2002-0210 (NPDES No. CA 0078662). This Order includes a Monitoring and Reporting Program, which requires the District to monitor Deer Creek temperature weekly at the R1 (upstream) and R2 (downstream) monitoring sites. This monitoring currently occurs and would continue as long as the District discharges treated municipal wastewater to Deer Creek. No additional program for collection of temperature data is necessary. However, upon final approval of the proposed site-specific temperature objectives by U.S. EPA, the NPDES permit for the DCWWTP should be re-opened by Regional Board staff and modified to include the adopted temperature objectives as receiving water temperature limitations. In addition, the NPDES permit's Monitoring and Reporting Program should be modified to require more frequent temperature monitoring, relative to the current NPDES permit, at the R2 (downstream) location.

The District will continue to monitor Deer Creek water temperature at the R1 and R2 monitoring stations defined in its DCWWTP NPDES Permit, and will conduct hourly temperature monitoring at the R2 location upon U.S. EPA approval and implementation of the proposed site-specific temperature objectives. In addition to the NPDES monitoring requirements, the following temporary monitoring of creek temperatures will be required of the District as a condition of the proposed site-specific temperature objective's adoption. *In situ* temperature probes shall be deployed in Deer Creek to monitor hourly creek temperatures at Latrobe Road, Scott Road, and Wilton Road during the months of September through December and again April through June, for a period of three years following adoption of the proposed temperature objectives. This monitoring is requested by Regional Board Basin Planning staff to provide additional data on Deer Creek's seasonal downstream temperature profile during the months specified. Findings shall be disclosed to Regional Board Basin Planning staff in an annual technical report. If there is no flow at the monitoring site during any period that monitoring is required, it shall be noted in the annual report.

8.1.1.3 Flow Monitoring

The District will continue to monitor Deer Creek flow rate at the R1 monitoring station, as defined in its NPDES Permit for the DCWWTP. In addition to the NPDES monitoring requirements, the District will develop rating curves for the staff gages located on Deer Creek upstream of Scott Road and at Wilton Road, which are currently operated by Sacramento County for flood control purposes. The rating curve developed for each gage shall be capable of converting the staff gage reading into Deer Creek flow rate (cfs). The rating curves for both gages shall be developed within one year following adoption of the proposed temperature objectives. Following development of rating curves for these gages, the District shall, using the rating curves developed, estimate and document daily Deer Creek flow rates upstream of Scott Road and at the Wilton Road crossing for the periods September through December and again April through June. This monitoring is requested by Regional Board Basin Planning staff to provide additional data on Deer Creek's seasonal downstream flow profile during the months specified. Findings shall be disclosed to Regional Board Basin Planning staff in an annual technical report. If there is no flow at the monitoring site during any period that monitoring is required, it shall be noted in the annual report.

8.1.1.2 Biological Monitoring

In addition to conducting water quality monitoring weekly (see above), the District shall fund biological assessments of Deer Creek's BMI community (using CDFG's California Stream Bioassessment Protocol) twice/year (spring and fall) for two years (total of four surveys). The District has committed to fund these surveys and has already funded the first of four surveys, which was conducted by Bioassessment Services in the October 2000. Findings from this October 2000 BMI survey are discussed in this Draft Staff Report (see Section 3.2.1.1).

The District also shall monitor the hydrologic conditions that occur in Deer Creek and the Cosumnes River during the period October through April, annually using data collected from the Scott Road and Wilton Road automated gauging stations which are operated by the County of Sacramento following adoption of the proposed temperature objectives. In the event that hydrologic conditions conducive to potential opportunistic use of Deer Creek by anadromous salmonids occur, the District shall fund a fish survey to investigate whether anadromous fish made opportunistic use of Deer Creek. Conditions conducive to potential opportunistic anadromous fish use of Deer Creek are: 1) surface flow hydraulic continuity throughout Deer Creek, between Deer Creek and the Cosumnes River, and the Cosumnes River with the Mokelumne River during the period October 15 through December 31; or 2) daily flows at Michigan Bar on the Cosumnes River that rank in the top 25th percentile of flows at that site historically during one or more of the months January through April, with concurrent hydraulic continuity throughout Deer Creek and between Deer Creek with the Cosumnes River. Upon identifying either of the hydrologic conditions defined above, the District and its consultant shall meet with staff from the Regional Board, CDFG, and NMFS to cooperatively develop a study design that, when implemented timely, will collect data

appropriate for assessing whether anadromous fish made opportunistic use of Deer Creek and, if so, the relative magnitude and geographic extent of such use..

The CDFG April 1998 BMI survey (CDFG 1998), coupled with a BMI survey conducted during the fall of 2000 (BAS 2001), will be used to characterize existing conditions. Subsequent BMI surveys, following U.S. EPA approval of the proposed temperature amendments and associated revisions to the receiving water temperature limits in the NPDES permit, would provide additional biological data to characterize the relative health of the aquatic community over time. The details of these surveys (i.e., exact timing, sites to be surveyed, etc.) will be determined through future meetings of District, Regional Board, and CDFG staff, following approval of the proposed temperature amendments by U.S. EPA.

8.1.2 Regional Board Surveillance and Inspection

Regional Board surveillance and inspection activities for Deer Creek, a seasonally effluent-dominated water body, would include those currently being conducted under the NPDES Program. These include, but are not limited to, the following activities:

- 1) inspections of the DCWWTP facilities, operations, and records;
- 2) inspections of the physical, chemical, and biological characteristics of Deer Creek upstream and downstream from the DCWWTP; and
- 3) review of discharger-submitted self monitoring reports.

In addition, the Regional Board will continue to conduct compliance monitoring to determine permit compliance and validate self-monitoring reports. Discharger compliance monitoring is the responsibility of the Regional Board staff.

Finally, Regional Board staff would conduct investigations of complaints, if any are made to the Regional Board. Complaints from public or governmental agencies to the Regional Board regarding the discharge of pollutants or creation of nuisance conditions would be investigated and pertinent information collected.

8.2 USE OF MONITORING DATA

Monitoring data collected would be used to: 1) determine whether the proposed site-specific water quality objectives for Deer Creek are being achieved; 2) characterize resultant instream conditions, both chemical and biological, under the site-specific water quality objectives; and 3) assess the relative health of Deer Creek's aquatic ecology in the future, and whether the frequency of opportunistic use of Deer Creek by anadromous salmonids changes, relative to existing conditions, due to Cosumnes River restoration activities.

These monitoring data will provide a technical basis from which to review the proposed site-specific temperature objectives for Deer Creek as part of the Regional Board's triennial review of the Basin Plan.

9 ENVIRONMENTAL IMPACT REVIEW

9.1 INTRODUCTION

The planning process for Basin Plans has been certified by the Secretary of Resources as a regulatory program pursuant to Public Resources Code section 21080.5, and, California Environmental Quality Act (CEQA) Guidelines § 15251(g). Pursuant to Public Resources Code section 21080.5(c), the Basin Plan planning process is exempt from the provisions of the CEQA that relate to preparation of Environmental Impact Reports and Negative Declarations. This chapter satisfies the requirements of State Water Resources Control Board Regulations for *Implementation of CEQA, Exempt Regulatory Programs*, which are found in the California Code of Regulations, Title 23, Division 3, Chapter 27, Article 6, beginning at section 3775. Section 3777 requires preparation of:

- An environmental checklist; and
- A written report containing a brief description of the proposed activity or project, reasonable alternatives to the proposed activity, and mitigation measures to minimize any significant adverse environmental impacts of the proposed activity.

9.2 PROPOSED PROJECT

A site-specific amendment to the existing Basin Plan is being sought by the Regional Board, with support from the California Department of Fish and Game (CDFG) and the El Dorado Irrigation District (District). In addition, technical meetings were held with the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and U.S. Environmental Protection Agency (U.S. EPA) to help guide the development of the proposed amendments. Amendments to the Basin Plan are made by the Regional Board pursuant to Water Code section 13240 using a structured process involving scientific peer review, full public participation, state environmental review, and state and federal agency review and approval. In this case, the Proposed Project is approval of proposed site-specific water quality objectives for Deer Creek temperature that would be protective of Deer Creek's beneficial uses.

Upon adoption, compliance with the proposed site-specific temperature objectives would not result in any changes in Deer Creek temperature, relative to temperature conditions that currently exist in Deer Creek.

The proposed amendment would result in the following changes from the current Basin Plan requirements for temperature.

Current Basin Plan Objective: *"At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature."*

Proposed Site-specific Objective: “For Deer Creek, source to Cosumnes River, temperature changes due to discharges shall not cause creek temperatures to exceed the objectives stipulated in Table III-4A.”

TABLE III-4A
SPECIFIC TEMPERATURE OBJECTIVES FOR DEER CREEK

<i>Date</i>	<i>Daily Maximum (°F)^a</i>	<i>Monthly Average (°F)^b</i>
<i>January and February</i>	63	58
<i>March</i>	65	60
<i>April</i>	71	64
<i>May</i>	77	68
<i>June</i>	81	74
<i>July through September</i>	81	77
<i>October</i>	77	72
<i>November</i>	73	65
<i>December</i>	65	58

a Maximum not to be exceeded.

b Defined as a calendar month average.

Consistent with U.S. EPA’s recommendations, the change is elimination of the maximum allowed change from “natural temperatures” (i.e., 5°F) and use of seasonal, quantitative acute (daily maximum) and chronic (monthly average) temperature objectives developed specifically to maintain and protect the aquatic ecology and other beneficial uses of Deer Creek.

Environmental analyses often assess the impacts of a change in a plan by comparing the physical circumstances that would result from the plan amendment to the physical circumstances existing at the time the environmental documentation is prepared. This chapter provides this analysis by comparing the results of compliance with the proposed site-specific Basin Plan amendment to the physical circumstances currently existing in and around Deer Creek. The temperature conditions in Deer Creek under compliance with the proposed site-specific Basin Plan amendments would be the same as conditions that currently exist in the creek. However, the current Basin Plan objective for temperature is not presently being met in the creek during all periods of the year.

Because the proposed project is an amendment to an existing plan, this chapter also compares the physical circumstances that would result from compliance with the amended Basin Plan to circumstances that would result from compliance with the existing Basin Plan. Anticipated temperature conditions in Deer Creek under compliance with current Basin Plan objectives versus compliance with the proposed amendments would not differ, or would differ little, during the January through June period. The proposed objectives would be similarly or more restrictive than the current Basin Plan objective during the July through September period. This is the period of the year when the creek’s water temperatures reach annual highs. The proposed objectives would be less restrictive than the current Basin Plan objective during the October through December period, thereby allowing higher creek temperatures to occur during

this period than under the current Basin Plan objective. Nevertheless, the proposed objectives would protect and maintain the creek's current and probable future aquatic life uses. Overall, the proposed objectives provide an essentially equivalent or higher level of protection, relative to the current Basin Plan objective, during the most ecologically critical periods of the year for temperature regulation.

This site-specific Basin Plan amendment cannot, because of the statutory requirements that must be met, cause any significant impacts to the beneficial uses of Deer Creek. The only environmental impacts that might occur would be to environmental resources that are unrelated to the beneficial uses of Deer Creek. As shown in this section, the project would have no significant impacts to those other environmental resources, while the no project alternative is likely to have significant adverse impacts to those environmental resources.

9.3 ENVIRONMENTAL CHECKLIST

1. Project Title:

Site-specific Basin Plan amendment to the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins for Deer Creek temperature, El Dorado and Sacramento counties.

2. Lead Agency Name and Address:

California Regional Water Quality Control Board, 3443 Routier Road, Suite A, Sacramento, CA 95827-3003.

3. Contact Person and Phone Number:

Rik Rasmussen, Environmental Scientist (916) 255-3103.

4. Project Location:

Deer Creek, California, from its headwaters just north of Cameron Park Lake, located in the west-central portion of El Dorado County, to its confluence with the Cosumnes River, located near State Highway 99 in Sacramento County.

5. Project Sponsor's Name and Address:

California Regional Water Quality Control Board, 3443 Routier Road, Suite A, Sacramento, CA 95827-3098

6. General Plan Designation:

Not applicable

7. Zoning:

Not applicable

8. Description of Project:

The California Regional Water Quality Control Board, Central Valley Region (Regional Board) is proposing a site-specific amendment to the temperature

objective for Deer Creek in the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins. The purpose of the proposed amendment is to: (1) address a key regulatory issue associated with temperature in Deer Creek, a seasonally effluent-dominated water body; and (2) update the scientific basis for the temperature objective currently applicable to Deer Creek. Addressing regulatory issues associated with effluent dominated/dependant water bodies is a high priority of the Regional Board's Basin Planning Unit, as identified through the 1999 triennial review.

9. Surrounding Land Uses and Setting:

The areas potentially affected by this site-specific amendment include the waters of Deer Creek, source to the Cosumnes River. Deer Creek is a small, ephemeral creek draining the lower woodlands of the western Sierra Nevada foothills in El Dorado and Sacramento Counties. Deer Creek represents the primary water course of its watershed, covering approximately seven square miles. The land uses along Deer Creek include natural woodlands, wetland habitat, residential, urban, and agriculture. The District's DCWWTP is the only municipal wastewater treatment plant discharging to Deer Creek. Beneficial uses of Deer Creek are identified in Section 3 of this Staff Report. Deer Creek is tributary to the Cosumnes River, near the Highway 99 crossing of the Cosumnes River, in Sacramento County. (See Section 1.1.3 of this Staff Report for additional description of the setting, and **Error! Reference source not found.** for a vicinity map.)

10. Other public agencies whose approval is required:

State Water Resources Control Board
Office of Administrative Law
United States Environmental Protection Agency

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental resource categories identified below are analyzed herein to determine whether the Proposed Project would result in adverse impacts to any of these resources. None of the categories below are checked because the Proposed Project is not expected to result in "significant or potentially significant impacts" to any of these resources.

- | | |
|--|---|
| <input type="checkbox"/> Aesthetics | <input type="checkbox"/> Biological Resources |
| <input type="checkbox"/> Hazards & Hazardous Materials | <input type="checkbox"/> Mineral Resources |
| <input type="checkbox"/> Public Services | <input type="checkbox"/> Utilities/Service Systems |
| <input type="checkbox"/> Agriculture Resources | <input type="checkbox"/> Cultural Resources |
| <input type="checkbox"/> Hydrology/Water Quality | <input type="checkbox"/> Noise |
| <input type="checkbox"/> Recreation | <input type="checkbox"/> Mandatory Findings of Significance |
| <input type="checkbox"/> Air Quality | <input type="checkbox"/> Geology/Soils |
| <input type="checkbox"/> Land Use Planning | <input type="checkbox"/> Transportation/Traffic |

On the basis of this initial evaluation:

- ☒ I find that the Proposed Project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.¹
- ☐ I find that although the Proposed Project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the Project have been made by or agreed to by the Project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.
- ☐ I find that the Proposed Project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.
- ☐ I find that the Proposed Project MAY have a “potentially significant impact” or “potentially significant unless mitigated” impact on the environment, but at least one effect: 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.
- ☐ I find that although the Proposed Project could have a significant effect on the environment because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the Proposed Project, nothing further is required.

_____ Signature	_____ Date
_____ Printed name	_____ For

EVALUATION OF ENVIRONMENTAL IMPACTS

- 1) A brief explanation is required for all answers except “No Impact” answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A “No Impact” answer is adequately supported if the referenced information sources show that the impact simply does not apply to Project’s like the one involved (e.g., the Project falls outside a fault rupture zone). A “No Impact” answer should be explained where it is based on Project-specific factors as well as general standards (e.g., the Project will not

¹ As noted in Section 9.1 above, this chapter includes the report required by 23 Cal. Code Regs. § 3777 in lieu of an environmental impact report or negative declaration.

expose sensitive receptors to pollutants, based on a Project-specific screening analysis).

- 2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as Project-level, indirect as well as direct, and construction as well as operational impacts.
- 3) Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.
- 4) "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from Section XVII, "Earlier Analysis," may be cross-referenced).
- 5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063 (c)(3)(D). In this case, a brief discussion should identify the following:
 - a) Earlier Analysis Used. Identify and state where they are available for review.
 - b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.
 - c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the Project.
- 6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.
- 7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

- 8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a Project's environmental effects in whatever format is selected.
- 9) The explanation of each issue should identify:
- The significance criteria or threshold, if any, used to evaluate each question; and
 - The mitigation measure identified, if any, to reduce the impact to less than significant.

The Environmental Checklist has been prepared in compliance with the requirements of CEQA relating to certified regulatory programs. A statement of facts, supportive discussions, and/or confirming data support each finding of the checklist (see Evaluation of Potential Environmental Impacts). Where appropriate, the supporting discussions are referenced to relevant evaluations and assessments provided in other sections of this Staff Report or its technical appendices.

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	No IMPACT
I. AESTHETICS Would the Project:				
a) Have a substantial adverse effect on a scenic vista?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
II. AGRICULTURE RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the Project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

III. AIR QUALITY – Where available, the significance criteria established by the applicable air quality management or air pollution control the District may be relied upon to make the following determinations. Would the Project:

a) Conflict with or obstruct implementation of the applicable air quality plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Expose sensitive receptors to substantial pollutant concentrations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Create objectionable odors affecting a substantial number of people?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

IV. BIOLOGICAL RESOURCES – Would the Project:

a) Have a substantial adverse effect, either directly, or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulators, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US fish and Wildlife Service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
wildlife corridors, or impede the use of native wildlife nursery sites?				
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

V. CULTURAL RESOURCES – Would the Project:

a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Directly or indirectly destroy a unique paleontological resource of site or unique geological feature?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Disturb any human remains, including those interred outside of formal cemeteries?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

VI. GEOLOGY AND SOILS – Would the Project:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ii) Strong seismic ground shaking?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
lii) Seismic-related ground failure,, including liquefaction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
iv) Landslides?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Result in substantial soil erosion or the loss of topsoil?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform building Code (1994), creating substantial	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
risks to life or property?				

VII. HAZARDS AND HAZARDOUS MATERIALS – Would the Project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project result in a safety hazard for people residing or working in the Project area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) For a Project within the vicinity of a private airstrip, would the Project result in a safety hazard for people residing or working in the Project area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

VIII. HYDROLOGY AND WATER QUALITY – Would the Project:

a) Violate any water quality standards or waste discharge requirements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
level (e.g., the production rate of preexisting nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted?				
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which results in flooding on- or off-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Create or contribute runoff water which exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Otherwise substantially degrade water quality?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
j) Inundation by seiche, tsunami, or mudflow?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
IX. LAND USE AND PLANNING – Would the Project:				
a) Physically divide an established community?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Conflict with any applicable habitat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
conservation plan or natural community conservation plan?				

X. MINERAL RESOURCES – Would the Project:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

XI. NOISE – Would the Project result in:

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) A substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) A substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project expose people residing or working in the Project area to excessive noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) For a Project within the vicinity of a private airstrip, would the Project expose people residing or working in the Project area to excessive noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

XII. POPULATION AND HOUSING – Would the Project?

a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Displace substantial numbers of people, necessitating the construction of	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
replacement housing elsewhere?				

XIII. PUBLIC SERVICES

a) Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

Fire protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Police protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Schools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Parks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other public facilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

XIV. RECREATION

a) Would the Project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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b) Does the Project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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XV. TRANSPORTATION/TRAFFIC – Would the Project:

a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio to roads, or congestion at intersections?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion/management agency for designated roads or highways?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
e) Result in inadequate emergency access?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Result in inadequate parking capacity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

XVI. UTILITIES AND SERVICE SYSTEMS – Would the Project?

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Have sufficient water supplies available to serve the Project from existing entitlements and resources, or are new or expanded entitlements needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Result in a determination by the wastewater treatment provider which serves or may serve the Project that it has adequate capacity to serve the Project's projected demand in addition to the provider's existing commitments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Be served by a landfill with sufficient permitted capacity to accommodate the Project's solid waste disposal needs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Comply with federal, state, and local statutes and regulations related to solid waste?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

XVII. MANDATORY FINDINGS OF SIGNIFICANCE

a) Does the Project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Does the Project have impacts that are	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

IMPACT	POTENTIALLY SIGNIFICANT IMPACT	POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION	LESS THAN SIGNIFICANT IMPACT	NO IMPACT
individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?				
c) Does the Project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

9.4 THRESHOLDS OF SIGNIFICANCE

For the purposes of making impact determinations, potential impacts were determined to be significant if the Proposed Project or its alternatives would result in one or both of the following:

- temperature conditions in Deer Creek that would adversely affect Deer Creek's beneficial uses; or
- a change in environmental condition that would, either directly or indirectly, cause a substantial loss of habitat or substantial degradation of water quality or other resources.

9.5 ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

Each resource category of the Environmental Checklist is supported by the following discussions and source information, as cited.

9.5.1 Aesthetics

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment.

Approval and implementation of the proposed site-specific temperature objectives would not result in substantial changes in temperature conditions in Deer Creek or downstream water bodies, relative to existing conditions. The Proposed Project would not necessitate any change in facilities or operations of the DCWWTP; therefore, downstream flows and water quality would remain unchanged, relative to existing conditions, all other factors remaining constant. The existing temperature conditions in Deer Creek are protective of the Creek's beneficial uses. Temperature levels are not adversely affecting any resources currently.

Anticipated temperature conditions in Deer Creek under the proposed site-specific objectives would occasionally differ somewhat from temperature conditions under compliance with the current Basin Plan objective for temperature. These differences in temperature levels would not be expected to have perceptible effects on Deer Creek's aquatic ecology, flows, riparian habitats, or any other aesthetic qualities of the creek. Overall, the proposed site-specific Basin Plan amendment would have **no impact** to the aesthetic qualities of Deer Creek or downstream water bodies.

9.5.2 Agricultural Resources

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment.

Approval and implementation of the proposed site-specific temperature objectives would not result in substantial changes in temperature conditions in Deer Creek, or downstream water bodies, relative to existing conditions. Existing temperature conditions in Deer Creek are not adversely affecting agricultural resources.

Anticipated temperature conditions in Deer Creek under the proposed site-specific objectives would occasionally differ somewhat from temperature conditions under compliance with the current Basin Plan objectives for these parameters. Deer Creek temperature conditions anticipated to occur under the proposed objectives would be protective of agricultural uses of Deer Creek water. Consequently, no agricultural resources, including farmland irrigation and livestock watering, would be affected by the Proposed Project.

Overall, the proposed site-specific Basin Plan amendment would have **no impact** on agricultural resources of Deer Creek or downstream water bodies.

9.5.3 Air Quality

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. Because creek temperatures do not affect air quality directly, there would be no direct impacts from the Proposed Project on air quality. Because implementation of the Proposed Project would not involve any construction-related activities that would generate increased concentrations of pollutants, objectionable odors, or obstruct the implementation of any air quality plan, there would be no secondary impacts from the Proposed Project on air quality. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on air quality.

9.5.4 Biological Resources

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. Approval and implementation of the proposed site-specific temperature objectives would not result in substantial changes in temperature conditions in Deer Creek, or downstream water bodies, relative to existing conditions. Moreover, existing creek temperature conditions are not adversely affecting the creek's existing aquatic communities. This can be demonstrated by the five fish surveys and three benthic macroinvertebrate surveys that have been conducted on upper Deer Creek (in the vicinity of the DCWWTP) between 1993 and 2000 (for a detailed discussion of findings, see Section 3.2.1.1 of this Staff Report). The creek supports a diverse assemblage of healthy, self-sustaining populations of fish and benthic macroinvertebrates, both upstream and downstream of the DCWWTP, that are typical for a creek of its characteristics and geographic location (USGS 2000; CDFG 1998; SWRI 1996; BAS 2001; SWRCB 1995).

Weekly monitoring of Deer Creek temperature from the District's R1 monitoring station (located approximately 0.25 miles (400 m) upstream of the point of effluent mixing under low-flow conditions and about 100 m upstream under high-flow conditions) to the Cosumnes River at Hwy 99 was conducted by SWRI between February 3, 1998 and March 3, 1998. Of the dates monitored, the Deer Creek flow rate was highest on February 3 (when the creek was at flood stage) and declined for all subsequent monitoring events through March 3. Dilution ratios for receiving water to effluent volumes were estimated to be well in excess of 100:1 on February 3, and were estimated to be approximately 8:1, 7:1, and 5:1 on February 16, February 26, and March 3, respectively. During all four sampling events, Deer Creek had visible discharge into the Cosumnes River. However, on March 3, 1998, when Deer Creek and effluent discharges were measured at approximately 28 cfs (18.1 mgd) and 4.9 cfs (3.2 mgd), respectively, the discharge of Deer Creek into the Cosumnes River was minimal.

The temperature data collected during the February 3, 1998 through March 3, 1998 period (when Deer Creek was hydraulically connected to the Cosumnes River) demonstrate three important points. First, during high flow conditions associated with significant precipitation events during the winter period, water temperatures in Deer Creek between the R1 location to Sloughouse differ little (e.g., less than 1°C on February 3 and 16, 1998), and the temperature of the Cosumnes River differs little, if at all, from that of Deer Creek at Sloughouse (Figure 6). This is likely due to large river discharges (which are influenced by ambient air temperatures less than are small discharges) and cool ambient air temperatures. Second, as shown by the difference in Deer Creek temperatures between the R1 and R2 locations, the influence of effluent discharges on creek temperature immediately downstream from the point of discharge (i.e., at R2) was minimal (i.e., less than 1°C) on all four dates monitored (Figure 6). Third, even on dates when Deer Creek temperatures increased measurably with increasing distance downstream from the DCWWTP (e.g., February 26 and March 3, 1998), the temperature measured in the Cosumnes River at Wilton Road (prior to

mixing with Deer Creek) and Hwy 99 (after mixing with Deer Creek) did not differ measurably from each other (Figure 6).

The data discussed above indicate that Deer Creek's influence on Cosumnes River temperature is insignificant. The data collected between February 3, 1998 and March 3, 1998 further indicate that temperatures in the lower reaches of Deer Creek under high-flow conditions are primarily influenced by ambient air temperatures, surrounding land use, tributary input and water movement, but have little to no relation to creek temperature immediately above or below the DCWWTP. Consequently, when Deer Creek has surface flow continuity with the Cosumnes River, effluent discharges from the DCWWTP have negligible effect on the temperatures of Deer Creek in its lower reaches or on water temperatures in the Cosumnes River. When Deer Creek lacks surface flow continuity with the Cosumnes River, its discharge to the Cosumnes River is possibly subterranean in nature. Under such conditions, Deer Creek would be expected to have negligible, if any, effect on Cosumnes River temperatures. These findings indicate that implementation of the proposed set of seasonal, site-specific temperature objectives for Deer Creek would have no measurable effects on Cosumnes River temperature and, therefore, aquatic life during any month of the year.

Anticipated temperature conditions in Deer Creek under the proposed site-specific objectives would occasionally differ somewhat from temperature conditions under compliance with the current Basin Plan objectives for this parameter (see section 5.3). Nevertheless, the proposed site-specific temperature objectives would maintain and be protective of Deer Creek's aquatic biological resources. The seasonal difference that could occur in creek temperature between the proposed and current temperature objectives would have less-than-significant effects on aquatic biota within Deer Creek and downstream water bodies.

Overall, the proposed site-specific temperature objectives would have a **less-than-significant impact** to biological resources.

9.5.5 Cultural Resources

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. The Proposed Project would not involve any action or activity that would cause an adverse change in historical, archaeological, paleontological resources, or human remains (e.g., exposure, destruction). Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on cultural resources.

9.5.6 Geology and Soils

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. The Proposed Project would not involve any action or physical activity (e.g., construction) that would expose people or structures to the risk of loss, injury, or death involving a known earthquake fault, strong seismic ground shaking, seismic related ground failure,

or landslides. Also, the Proposed Project would not involve any action or result in any changing of hydrological regimes that would expose people or structures to increased soil erosion, unstable soil, or expansive soil. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on geology or soils.

9.5.7 Hazards and Hazardous Materials

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. No changes to physical facilities or operations at the DCWWTP or other facilities would be required under the Proposed Project. As such, the Proposed Project would not involve new hazards or any action or physical activity that would introduce or remove hazardous materials. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on current or potential hazards or hazardous materials.

9.5.8 Hydrology and Water Quality

9.5.8.1 Hydrology

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. Approval and implementation of the proposed site-specific temperature objectives would have no direct effect on Deer Creek hydrology, relative to existing conditions. Existing creek hydrology is not adversely affecting the creek's aquatic communities, or other beneficial uses. In addition, anticipated creek hydrology under the proposed site-specific objectives would be identical to creek hydrology under the current Basin Plan objectives for temperature.

Additionally, the Proposed Project would not affect erosion or siltation rates, existing drainage pattern of the site or area, or the amount of area runoff. The Proposed Project would not change the 100-year flood magnitude or route, expose people or structures to significant risk of loss, injury, or death involving flooding, or increase the potential for inundation by seiche, tsunami, or mudflow. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on hydrology of Deer Creek or downstream water bodies.

9.5.8.2 Water Quality

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. Hence, the Proposed Project has the potential to *affect* creek temperatures, but would have negligible, if any, effects on other water quality parameters. However, the site-specific temperature objectives proposed were developed to maintain the instream beneficial uses of Deer Creek and the level of water quality necessary to protect these uses. Approval and implementation of the proposed site-specific temperature objectives would not result in substantial changes in temperature conditions in Deer Creek or

downstream water bodies, relative to existing conditions. Moreover, existing creek temperature conditions are not adversely affecting the creek's beneficial uses.

Anticipated temperature conditions in Deer Creek under the proposed site-specific objectives would occasionally differ somewhat from temperature conditions under compliance with the current Basin Plan objective. The occasional differences that could occur in creek temperature between the proposed and current temperature objectives are not of sufficient magnitude and frequency to adversely affect any of the creek's beneficial uses. Therefore, the proposed site-specific Basin Plan amendment would have **less-than-significant impacts** to water quality.

9.5.9 Land Use and Planning

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. The Proposed Project would not involve any action, physical activity, or land use change that would divide any established community, conflict with any land use plan, policy or regulation, or conflict with any habitat conservation plan or natural community plan. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on land use and planning.

9.5.10 Mineral Resources

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. The Proposed Project would not involve any action or physical activity that would result in the loss of any known mineral resource or known mineral resource site. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on mineral resources.

9.5.11 Noise

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. The Project would not involve any action or physical activity (e.g., construction) that would result in increased noise levels or exposure of people to noise. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on noise.

9.5.12 Population and Housing

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. The immigration of people to an area is typically influenced by such factors as job opportunities, affordable housing, quality schools and public services, and aesthetic quality, among others. Site-specific temperature objectives for Deer Creek will not likely encourage or discourage people from moving to the Deer Creek area. Also, since the Project involves no action or physical activity associated with land conversions, no housing would need to be relocated or otherwise be affected. Therefore,

implementation of the proposed site-specific Basin Plan amendment would have **no impact** on population or housing.

9.5.13 Public Services

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. The Proposed Project would not involve any action that would adversely affect fire protection, police protection, schools, parks, or any other public facility. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on public services.

9.5.14 Recreation

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. Approval and implementation of the proposed site-specific temperature objectives would not result in substantial changes in temperature conditions in Deer Creek or downstream water bodies, relative to existing conditions. Existing creek temperature conditions are not adversely affecting recreation in or along Deer Creek. The Proposed Project would have no direct impact on recreational use of the creek or surrounding areas. Moreover, because the Proposed Project would not result in any substantial adverse effects on creek biological resources or aesthetics (see above), it would not indirectly affect recreation in or along Deer Creek. Finally, the Proposed Project would have no impacts on existing or probable future recreational facilities in that no new structures or alterations of existing facilities or land uses are proposed.

Anticipated temperature conditions in Deer Creek under the proposed site-specific objectives would occasionally differ somewhat from temperature conditions under compliance with the current Basin Plan objectives for this parameter (see section 5.3). Nevertheless, the proposed site-specific temperature objectives would maintain and be protective of Deer Creek's recreational uses, which were considered in their development. The seasonal difference that could occur in creek temperature between the proposed and current temperature objectives would have no direct or indirect effects on recreation in Deer Creek or downstream water bodies. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on recreation in or along the Deer Creek, downstream water bodies, or surrounding areas.

9.5.15 Transportation/Traffic

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. The Proposed Project would not involve any action that would affect amounts of traffic or congestion, road management, traffic patterns, traffic hazards, emergency access, parking, or current transportation policies. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on transportation or traffic.

9.5.16 Utilities and Service Systems

The Proposed Project would establish site-specific temperature objectives for Deer Creek through approval of the proposed site-specific Basin Plan amendment. The Proposed Project would not involve any action that would affect the current regulations or utilities or the need for new utilities. Therefore, the proposed site-specific Basin Plan amendment would have **no impact** on utilities and service systems.

9.5.17 Mandatory Findings of Significance

Because there would be no significant Project or cumulative impacts (see Section 9.6), no mandatory findings of significance are required.

9.6 CUMULATIVE IMPACT ANALYSIS FOR THE PROPOSED PROJECT

Cumulative impacts refer to one or more individual effects which, when taken together, are considerable or which compound or increase other environmental impacts. Such effects result from the incremental impact of a project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period-of-time.

Staff is currently reviewing its recommendations for site-specific Basin Plan amendments for Deer Creek pH and turbidity objectives. This proposed temperature objective was originally included in the same documentation; however, additional time was needed to develop the temperature objective. Consequently, the temperature objective was split-out, and is now being processed separately.

Like the proposed site-specific objectives for Deer Creek pH and turbidity, the proposed site-specific temperature objective was developed to protect and maintain Deer Creek's aquatic biological resources and other beneficial uses. There is no anticipated circumstance where impacts of pH and turbidity objectives could cumulate with impacts of the temperature objectives proposed herein. There are no circumstances that can reasonably be forecast for the unique combination of environmental conditions in the affected area under which the combination of pH, turbidity, and temperature objectives would collectively cause a significant adverse cumulative impact to Deer Creek aquatic life or any other environmental resource.

Any future development projects in the affected area would be required to comply with the proposed site-specific temperature objectives, to the extent they are applicable. Accordingly, the impacts of individual development projects could not cumulate with the impacts of amending the temperature objectives applicable to Deer Creek. The Proposed Project would not have an incremental effect or a cumulatively considerable incremental effect on identified resources in light of any development projects.

9.7 THE NO PROJECT/CURRENT BASIN PLAN ALTERNATIVE

This Staff Report concludes that the Proposed Project will not cause any potentially significant impacts. Therefore, there are no mitigation measures or alternatives that could reduce or avoid significant impacts. Nevertheless, this report analyzes a No Project/Current Basin Plan Alternative to comply with the requirements for an EIR, and thus is not merely the equivalent of a Negative Declaration, thereby providing additional context for decision-making parties. The No Project/Current Basin Plan Alternative is not environmentally superior to the Proposed Project.

The No Project/Current Basin Plan Alternative characterizes what would happen if the Proposed Project (i.e., site-specific Basin Plan amendment for Deer Creek temperature) is not approved and implemented. Under the No Project/Current Basin Plan Alternative, Regional Board and District staff have identified options that the District could, theoretically, implement to comply with the current Basin Plan objectives for receiving water temperature. These options are:

- Option 1 – Additional Treatment Facilities;
- Option 2 – Effluent Reuse;
- Option 3 – Connect to Sacramento Regional Wastewater Treatment Plant (SRWTP);
- Option 4 – Pool Habitat Enhancement;
- Option 5 – Riparian Habitat Enhancement; and
- Option 6 – Quarry Water Discharge.

Options carried forward for detailed analysis were Option 1 – Additional Treatment Facilities, Option 2 – Effluent Reuse, and Option 3 – Connecting to the SRWTP. Options 4-6 were not considered viable at this time because either too little is known or the option would not likely facilitate compliance with the current Basin Plan temperature objective. The options not carried forward for detailed analysis, therefore, were creation of additional and/or expanded pool habitat (Option 4), establishment of additional riparian habitat/shaded cover (Option 5), and discharge of quarry water to offset thermal loading (Option 6). Although not carried forward for detailed analysis, brief discussions of options 4-6 are provided below.

Pool Habitat Enhancement: Pool habitat enhancement was identified early in the process as a potential habitat-enhancement option for addressing the temperature issue at Deer Creek. Pool habitats within Deer Creek are not thermally stratified from surface to bottom because they lack sufficient depth for thermal stratification to occur. Pool habitats in a shallow creek of this nature would provide no thermal refugia for aquatic species, unless they are spring fed. Temperatures in non-spring-fed pools (i.e., the majority of the pools within Deer Creek) have little temperature change between the surface and the bottom of the pool. Lack of a “coldwater” layer in the bottom of pool habitats eliminates the possibility of any significant cooling of the surface waters within the pool (via conduction). Therefore, creation of additional pool habitat in Deer Creek would not provide thermal refugia for aquatic life, nor would it contribute to cooling of creek waters. In fact, pool habitat typical of that in Deer Creek generally contribute to

creek warming during the summer months, due to heat gain from solar radiation across the larger surface area of pools. Based on the above, this option was not considered viable for addressing compliance with the current Basin Plan temperature objective and, therefore, is not discussed further in this report.

Riparian Habitat Enhancement: Riparian habitat enhancement also was identified early in process as a potential habitat-enhancement option for addressing the temperature issue at Deer Creek. A heavily vegetated riparian corridor currently exists along most reaches of Deer Creek from its headwaters to many miles downstream of the DCWWTP. Consequently, the additional opportunity for enhancement of this riparian corridor is minimal. Moreover, the shading of the creek by riparian vegetation reduces temperature increases with increasing distance downstream during the summer and fall months (when ambient air temperatures are high), but does not directly or indirectly address the fact that effluent temperatures are often more than 5°F greater than creek temperatures during the fall months. Therefore, this option was not considered viable for addressing compliance with the current Basin Plan temperature objective and thus is not discussed further in this report.

Quarry Water Discharge: A former limestone quarry exists in the Marble Valley region, approximately one mile from the DCWWTP. The possibility of pumping cool water from the quarry to Deer Creek to offset thermal loading from effluent discharges has been given preliminary consideration. However, available information is not adequate to thoroughly evaluate this proposal. Detailed hydrologic, water quality, and possibly other studies would be required to determine whether this option might be feasible. No detailed data exist about the seasonal temperatures of the quarry water, its pH and other water quality characteristics, and the costs associated with pumping the water into Deer Creek. Little, if any, detailed quantitative data exist about the sustainable rate at which water could be pumped from the quarry. Brown and Caldwell (1996) indicated that the spring within the quarry was producing about 200 gpm in 1995, when the quarry pit was filled. Thus, the detailed information that would be needed to determine if this option might be feasible is lacking. In addition, the District does not own the quarry. Therefore, the District could not manage the discharge of groundwater to Deer Creek without acquiring control over the quarry water, such as by purchase, lease, etc. In sum, based on the large technical and resource control uncertainties associated with this option, it was not carried forward for further evaluation.

Detailed descriptions of Options 1-3 that would facilitate compliance with the current Basin Plan temperature objective, and their respective implementation considerations and environmental impacts, are discussed in the following subsections. A summary comparison of the Proposed Project to each of the three options under the No Project/Current Basin Plan Alternative is provided in **Table 7** and

Table 8. These discussions focus on how the three options *differ* from the Proposed Project, and do not reiterate the impacts and considerations of each option that are comparable to those of the Proposed Project.

Table 7. Comparison of environmental impacts under the Proposed Project to those identified for each of the three options associated with the No Project/Current Basin Plan Alternative.

Resource Category	Proposed Project	No Project/Current Basin Plan Alternative		
		Option 1 (Add. Trt. Facil.)	Option 2 (Effl. Reuse)	Option 3 (SRWTP)
Aesthetics	No Impact	No Impact	Significant: Project-specific and cumulative for Deer Creek	Significant: Project-specific and cumulative for Deer Creek
Agricultural Resources	No Impact	No Impact	No Impact	No Impact
Air Quality	No Impact	LTS*	LTS	LTS
Biological Resources	LTS	LTS	Significant: Project-specific and cumulative for Deer Creek Potentially Significant: Cumulative impact to region	Significant: Project-specific and cumulative for Deer Creek Potentially Significant: Cumulative impact to region
Cultural Resources	No Impact	No Impact	LTS	LTS
Geology and Soils	No Impact	No Impact	No Impact	No Impact
Hazards and Haz. Materials	No Impact	LTS	LTS	No Impact
Hydrology	No Impact	No Impact	Significant: Project-specific and cumulative for Deer Creek Beneficial: For water bodies serving District water supplies	Significant: Project-specific and cumulative for Deer Creek LTS: For Sac. River
Land Use and Planning	No Impact	No Impact	No Impact	No Impact
Mineral Resources	No Impact	No Impact	No Impact	No Impact
Noise	No Impact	LTS	LTS	LTS
Population and Housing	No Impact	No Impact	No Impact	No Impact
Public Services	No Impact	No Impact	No Impact	No Impact
Recreation	No Impact	No Impact	Significant: Project-specific and cumulative for Deer Creek	Significant: Project-specific and cumulative for Deer Creek LTS: For Sac. River
Transportation/Traffic	No Impact	LTS	LTS	LTS
Utilities and Service Systems	No Impact	No Impact	No Impact	No Impact
Water Quality	LTS	LTS	Potentially Significant: Direct and cumulative for Deer Creek Significant: For Bass Lake	Potentially Significant: Direct and cumulative for Deer Creek

* Less than significant.

Table 8. Comparison of implementation considerations and economic impacts to the District of implementing the Proposed Project versus each of the three options associated with the No Project/Current Basin Plan Alternative.

Issue	Proposed Project	No Project/Current Basin Plan Alternative		
		Option 1 (Add. Trt. Facil.)	Option 2 (Effl. Reuse)	Option 3 (SRWTP)
Implementation Considerations	<ul style="list-style-type: none"> Approval of proposed SSBPAs Modification of NPDES permit to be consistent w/ amended Basin Plan Would resolve current regulatory problems associated w/ Deer Creek temperature 	<ul style="list-style-type: none"> Design and construction of additional facilities Operation of additional facilities May not resolve current regulatory problems associated w/ Deer Creek temperature on an instantaneous basis. 	<ul style="list-style-type: none"> Address the conditions of SWRCB Order WR 95-9, or obtain a further Order from the SWRCB Use of Bass Lake as a recycled water storage reservoir Need for off-site construction activities Significant environmental impacts to be mitigated May not fully resolve current regulatory problems associated w/ Deer Creek temperature 	<ul style="list-style-type: none"> Address the conditions of SWRCB Order WR 95-9, or obtain a further Order from the SWRCB Agreement with SRWTP Need for off-site construction activities Significant environmental impacts to be mitigated Would resolve current regulatory problems associated w/ Deer Creek temperature
Direct Capital Cost to District	\$0.3 million	\$2.9 million	\$18 million	\$38-52 million
Direct Cost to Other Parties	none	none	none	none

9.7.1 Option 1 – Additional Treatment Facilities

9.7.1.1 Description

Under Option 1 (Additional Treatment Facilities), the District's physical plant facilities and operations would be modified to comply with the current NPDES temperature limitation, which is based on the current Basin Plan's water quality objective for temperature. The following design parameters were established to design cooling towers for temperature control. These parameters are based on an analysis of the current creek temperature data:

- Maximum cooling required to comply with Current Basin Plan 10°F
- Maximum flow to be cooled 6 mgd
- Averaging period to determine stream temperature differential 1 month

Using these conditions, cooling towers would be capable of providing the necessary cooling. The 6 mgd flow represents the projected peak week dry weather flow and the average week winter dry period flow for a 3.6 mgd capacity plant. Both conditions occur when the ratio of stream flow to effluent flow would be the lowest or worst case. Flows in excess of 6 mgd are assumed to occur only during storms when the stream flow increases. With additional creek flow available for dilution during and immediately following winter storm events, plant flows in excess of 6 mgd probably would not need to be cooled to meet the delta 5°F temperature requirement. Using an averaging period of one month to determine the stream differential temperature allows for sizing of the cooling towers to handle average conditions but not necessarily all instantaneous conditions. It is recognized that the instantaneous stream differential temperature may exceed 5°F under certain conditions (OEMC 1998).

A wetwell would be constructed over the tertiary filter effluent channel. Cooling tower feed would be pumped from the wetwell with three vertical turbine pumps. The pumps would be equipped with variable flow devices to allow the cooling tower system to match the disinfection basin flow rate. Any flow in excess of 6 mgd would overflow the wetwell and continue on to the disinfection basin. The discharge line would have a Venturi type flow tube for measuring flow. The flow signal would be used to control the chemical metering pumps for addition of sodium hypochlorite and scaling control agents. The cooling tower feed piping would be equipped with pneumatically operated butterfly valves for each cell of the tower. The cooling tower would be located on top of the disinfection basins. A concrete slab would be constructed on top of the disinfection basin to provide a support floor for the cooling tower. Cooled effluent from the cooling towers would return to the process via piping to the cooling tower pump station overflow structure (OEMC 1998).

The effluent cooling system would consist of a cooling tower, a header system to split the water between different cells within the cooling tower, fans and motors to force air up through the tower, an electrical control panel (to control header valves, fans and motors, and monitoring systems), and piping for the cooled water to exit the tower and re-enter the wastewater stream. The tower would be constructed using fiberglass and stainless steel to resist corrosion (OEMC 1998).

Ancillary equipment, included as a part of the cooling system, would include chemical injection systems to introduce biological and scaling controls to the tower (chemical controls used include peroxide, chlorine, or proprietary dispersants), plume (mist) and noise reduction units; electronic level sensors; fiberglass ladders, walkways, gratings and handrails; and fire protection (OEMC 1998).

9.7.1.2 Implementation Considerations

Implementation of this option to meet the current Basin Plan objectives for temperature, while maintaining compliance with other NPDES permit requirements, would not require any additional regulatory actions. This option would require the District to incur approximately \$2.9 million in facility upgrades (OEMC 1998).

9.7.1.3 Environmental Impacts

Option 1 (Additional Treatment Facilities) of the No Project/Current Basin Plan Alternative would not eliminate any significant adverse impacts of the Proposed Project because there are none. Potential environmental impacts of implementing Option 1 of the No Project/Current Basin Plan Alternative would fall into two main categories: 1) short-term, construction-related impacts; and 2) long-term, operations-related impacts. Based on the above discussions, it can be reasonably concluded that both short-term construction and long-term operational activities associated with this option would have no impacts on the following resources:

- Aesthetics;
- Agricultural Resources;
- Cultural Resources;
- Geology and Soils;
- Hydrology;
- Land Use and Planning;
- Mineral Resources;
- Population and Housing;
- Public Services;
- Recreation; and
- Utilities and Service Systems.

Conversely, construction-related activities associated with Option 1 of the No Project/Current Basin Plan Alternative could potentially have temporary impacts to:

- Air Quality;
- Noise; and
- Transportation/Traffic.

Furthermore, operations of and discharge of effluent from the modified DCWWTP facility under Option 1 of the No Project/Current Basin Plan Alternative could potentially have long-term impacts to:

- Biological Resources;
- Hazards and Hazardous Materials;
- Transportation/Traffic; and
- Water Quality.

Potential short-term construction-related impacts and long-term impacts resulting from Option 1 of the No Project/Current Basin Plan Alternative are discussed separately below.

9.7.1.3.1 Construction-related Impacts

To consistently comply with the current Basin Plan objectives for temperature under Option 1 of the No Project/Current Basin Plan Alternative, construction and operation of new facilities at DCWWTP would be required. See Section 9.7.1.1 for a detailed description of these facilities. Because all necessary facilities would be constructed within the current site plan or “footprint” of DCWWTP, no expansion of the existing site

plan would be necessary. As such, no off-site land disturbances or clearing would occur. In addition, construction best management practices (BMPs) would be implemented to minimize and/or avoid impacts to resources resulting from on-site activities. Consequently, potential construction-related impacts to all resource categories would be minimal or completely avoided, with the possible exceptions of impacts to air quality, noise, and transportation/traffic.

Potential air quality, noise, and transportation/traffic impacts would be associated with transportation of workers, equipment, and supplies to and from the site, and operation of equipment on-site during the construction period. These transportation and construction activities would temporarily increase local traffic and noise levels, particularly within several miles of the plant site. Increased traffic levels could increase environmental exposure to hazardous materials (e.g., fuels, oils, lubricants, etc.). Construction BMPs would be implemented to minimize air quality, noise, and transportation/traffic impacts. Because BMPs would be implemented and because effects on these resource areas would be temporary, construction-related impacts to air quality, noise, and transportation/traffic under Option 1 of the No Project/Current Basin Plan Alternative would be **less-than-significant**.

9.7.1.3.2 Operations-related Impacts

9.7.1.3.2.1 Biological Resources

Operation of cooling towers requires periodic flushing with chlorine, or equivalent chemical, to remove algal growth. This would introduce a second chlorination/dechlorination step in the overall effluent treatment process. As such, it would increase the potential for chlorine to enter Deer Creek, which could cause toxicity to aquatic life. Nevertheless, operational procedures and protocols would be implemented to assure that dechlorination was effective and that any discharge of residual chlorine to Deer Creek would be prevented. Option 1 would not pose any other potential adverse effects to Deer Creek resources, nor would its implementation result in demonstrable benefits to the creek's aquatic ecology. Overall, implementation of Option 1 of the No Project/Current Basin Plan Alternative would have **less-than-significant impacts** to the biological resources of Deer Creek and downstream water bodies.

9.7.1.3.2.2 Hazards and Hazardous Materials

As discussed under Section 9.7.1.1, implementation of Option 1 of the No Project/Current Basin Plan Alternative would require additional transport and storage of chemicals at the DCWWTP, relative to existing conditions and conditions under the Proposed Project. However, based on the relative degree of additional transportation and storage required and the specific chemicals involved, this would constitute a **less-than-significant impact**.

9.7.1.3.2.3 Transportation/Traffic

Under Option 1 of the No Project/Current Basin Plan Alternative, additional deliveries of chemicals to the plant site would be required compared to existing conditions or

conditions under the Proposed Project. However, the incremental increase in trucking traffic anticipated for additional chemical deliveries to the plant site would be minimal. This minimal increase in deliveries would constitute a **less-than-significant impact**.

9.7.1.3.2.4 Water Quality

Operation of cooling towers requires periodic flushing with chlorine, or equivalent chemical, to remove algal growth. This would introduce a second chlorination/dechlorination step in the overall effluent treatment process. As such, it would increase the potential for chlorine to enter Deer Creek, which could cause toxicity to aquatic life. Nevertheless, operational procedures and protocols would be implemented to assure that dechlorination was effective and that any discharge of residual chlorine to Deer Creek would be prevented. The dechlorination process would add additional salts to the effluent being discharged to the creek. Although the additional salt load in the effluent would not adversely affect the creek's aquatic biological resources, it would incrementally contribute to higher downstream and Delta salt concentrations, which Delta water purveyors have identified as a key water quality parameter of concern. It should be noted, however, that this incremental increase in salt loading to downstream waters would be negligible. Overall, implementation of Option 1 of the No Project/Current Basin Plan Alternative would have **less-than-significant impacts** to water quality of Deer Creek and downstream water bodies.

9.7.2 Option 2 - Effluent Reuse

9.7.2.1 Description

Under the Option 2 (Effluent Reuse), the District would reuse effluent produced at the DCWWTP facility, thereby eliminating effluent discharge to Deer Creek, throughout the irrigation season as a means of complying with the current Basin Plan temperature objective. This alternative would require the following facilities (HDR 2000):

- Tertiary filters to treat total annual flow during the irrigation season. The filter plant would have to be approximately 10 mgd capacity.
- Pipelines to the seasonal storage.
- Seasonal storage of approximately 1,700 ac ft.
- Distribution piping to reuse users.

The capital cost associated with Option 2 would be approximately \$18 million.

9.7.2.2 Implementation Considerations

Two factors would affect the feasibility of completely reusing the wastewater stream and eliminating discharges to Deer Creek: 1) available market for sale of reuse water; and 2) the regulatory ability of the District to eliminate discharges to Deer Creek and treat the effluent for resale.

9.7.2.2.1 Market for Reuse Water

Potential uses for recycled wastewater in El Dorado County are irrigation uses for greenbelts, golf courses, playgrounds, and parks as well as some small industrial uses, dual water systems for new developments, and agricultural uses. These potential uses are delineated in HDR's "Recycled Water Master Plan" (HDR 2000).

Irrigation uses generally occur during the period May through October. This reuse period would not coincide with the period during which DCWWTP has experienced temperature compliance issues on Deer Creek, which is primarily May through December. Therefore, the Effluent Reuse Option would not be considered a fully viable option compared to developing site-specific temperature objectives for Deer Creek.

9.7.2.2.2 Regulatory Issues

The State Board issued Order WR 95-9, which imposes a condition on the State Board's approval of the District's treated wastewater change petition WW-20 requiring DCWWTP to discharge a minimum flow of 0.5 or 1 mgd to Deer Creek, depending on the quantity of treated wastewater that is produced. Modifying this condition would require addressing, in some manner, Order WR 95-9. Thus, if a change were to be sought, methods for obtaining such change would need to be investigated and evaluated. Order WR 95-9 states that the purpose of this condition of approval is to protect the stream environment created by the wastewater discharge (SWRCB 1995). A second regulatory issue relates to the ability to use Bass Lake as a reuse storage reservoir. Finally, this option may not fully resolve the current regulatory problems associated with Deer Creek temperature. For example, there is typically little to no recycle market in November, yet this is a key month for compliance problems with the current Basin Plan temperature objective.

9.7.2.3 Environmental Impacts

Implementation of Option 2 (Effluent Reuse) of the No Project/Current Basin Plan Alternative would not eliminate any significant adverse impacts of the Proposed Project because there are none.

Potential environmental impacts associated with Option 2 would fall into two main categories: 1) short-term, construction-related impacts; and 2) long-term, operations-related impacts. Based on the above discussions, it can be reasonably concluded that both short-term construction and long-term operational activities associated with Option 2 of the No Project/Current Basin Plan Alternative would have no impacts to the following resources:

- Agricultural Resources;
- Geology and Soils;
- Land Use and Planning;
- Mineral Resources;
- Population and Housing;
- Public Services; and
- Utilities and Service Systems.

Conversely, construction-related activities associated with Option 2 of the No Project/Current Basin Plan Alternative could potentially have impacts to:

- Air Quality;
- Noise;
- Cultural Resources; and
- Transportation/Traffic.

Furthermore, operations of the additional reuse facilities under Option 2 of the No Project/Current Basin Plan Alternative could potentially have long-term impacts to:

- Aesthetics;
- Biological Resources;
- Hazards and Hazardous Materials;
- Hydrology;
- Recreation; and
- Water Quality.

Potential short-term construction-related impacts and long-term impacts resulting from Option 2 of the No Project/Current Basin Plan Alternative are discussed separately below.

9.7.2.3.1 Construction-related Impacts

To consistently comply with the current Basin Plan objectives for temperature under Option 2 of the No Project/Current Basin Plan Alternative, construction and operation of new facilities at DCWWTP, and elsewhere off site, would be required. See Section 9.7.2.1 for a detailed description of these facilities. The construction of an onsite storage tank and pump at DCWWTP would be within the existing site plan or “footprint” of the plant. On-site construction activities would be conducted in a manner (i.e., using BMPs) that would result in less-than-significant impacts to local and onsite resources. Some of the necessary facilities would be constructed outside the current site plan or “footprint” of DCWWTP. As such, off-site land disturbances and/or clearing would occur (e.g., pipeline routes). Construction BMPs would be implemented to minimize and/or avoid impacts to resources resulting from both on-site and off-site construction activities. Consequently, potential construction-related impacts to all resource categories would be reduced to **less-than-significant** levels or completely avoided, with the possible exceptions of impacts to air quality, cultural resources, noise, and transportation/traffic.

9.7.2.3.1.1 Air Quality, Noise, and Transportation/Traffic

Potential air quality, noise, and transportation/traffic impacts are all associated with transportation of workers, equipment, and supplies to and from construction sites, and operation of equipment both on- and off-site during the construction period. These transportation and construction activities would temporarily increase local air pollution, traffic, and noise levels, particularly within several miles of construction areas. Increased traffic levels could, foreseeably, increase environmental exposure to hazardous materials (e.g., fuels, oils, lubricants, etc.). Construction BMPs would be implemented to minimize air quality, noise, and transportation/traffic impacts. Because

BMPs would be implemented and because effects on these resource areas would be temporary, construction-related impacts to air quality, noise, and transportation/traffic under Option 2 of the No Project/Current Basin Plan Alternative would be **less than significant**.

9.7.2.3.1.2 Cultural Resources

Option 2 of the No Project/Current Basin Plan Alternative would involve placement of reuse pipelines and other off-site construction activities. These activities have the potential to adversely affect buried cultural resources, pending the exact routing of pipelines and locations determined for other construction activities. However, because necessary construction BMPs and best possible routing of pipelines would be expected to be implemented to minimize or avoid impacts to buried artifacts and other cultural resources, this impact is considered **less than significant**.

9.7.2.3.2 Operations-related Impacts

9.7.2.3.2.1 Aesthetics

As a means of compliance with the current Basin Plan objectives for temperature, Option 2 of the No Project/Current Basin Plan Alternative proposes to eliminate discharge to the creek during the reuse period of the year (i.e., typically May through October). Some of the additional recycled water would be used to irrigate local golf courses greenbelts, and parks. Since people enjoy recreating on golf courses, greenbelt areas, and in parks, Option 2 of the No Project/Current Basin Plan Alternative could potentially contribute to improved aesthetics and recreational opportunities in these places.

Conversely, elimination of effluent discharges from the DCWWTP to Deer Creek during the May through October period would result in the following changes to Deer Creek:

- significantly reduced flows rates (SWRCB 1995);
- reduced amounts of downstream habitat for aquatic organisms (SWRCB 1995);
- elevated downstream water temperatures (because creeks having lower flows gain heat more rapidly during summer months, all else being equal);
- reduced acreage of riparian habitat and associated wildlife species utilizing the riparian corridor (SWRCB 1995); and
- fewer and shallower downstream pool habitats and associated reductions in the potential for swimming and boating opportunities.

Based on changes to Deer Creek (identified above), Option 2 of the No Project/Current Basin Plan Alternative would cause **significant** adverse impacts to the aesthetics and aesthetic enjoyment of Deer Creek, relative to existing conditions and conditions under the Proposed Project.

9.7.2.3.2.2 *Biological Resources*

SWRCB Order WR 95-9 states the following: returning Deer Creek to its natural state through elimination of effluent discharges from the DCWWTP to Deer Creek during the May through October period of the year would result in significant adverse changes to Deer Creek's aquatic and riparian habitats; ceasing effluent discharge during the summer season would negatively impact Deer Creek's aquatic biological resources; ceasing May through October effluent discharges to Deer Creek would significantly reduce the miles of wetted channel during these months of the year, downstream of the DCWWTP and, therefore, the number of miles of riparian habitat supported by the creek; and the aquatic habitat that would persist for a few miles below the DCWWTP would be substantially reduced in quality for sustaining fish populations and other aquatic communities (SWRCB 1995).

Ceasing effluent discharges to Deer Creek during the May through October period would cause Deer Creek to return to its natural state, under which surface flow continuity with the Cosumnes River would cease earlier in the year than it does now. Under Option 2, loss of surface flow continuity would probably occur in May/June compared to June/July under existing conditions and conditions under the Proposed Project. This would increase the chance that any steelhead, a species listed as threatened under the federal ESA, opportunistically produced in the creek under certain hydrologic and water temperature conditions would become isolated from downstream waters prior to the creek's average water temperatures reaching a level (e.g., about 68°F) that would trigger juvenile steelhead emigration from the creek. Any juvenile steelhead isolated from downstream waters in spring would likely be lost due, either directly or indirectly, to thermal stress during the summer period.

Finally, use of Bass Lake as a recycled water storage reservoir could adversely affect the lake's existing biological resources. While the reservoir now supports a population of warm water fish (bass, crappie, and bluegill), converting the reservoir to purely effluent storage with little dilution from the limited watershed runoff could result in fish mortality during periods of intense reclaimed water use and/or periods of low dissolved oxygen associated with large-scale plant die-offs. Eventually, the reservoir would become devoid of game fish species and could assume the water quality characteristics of a typical reclaimed water storage reservoir. These reservoirs support algae population densities many times those encountered in a typical surface water storage reservoir of similar morphology, and more variable water quality. Both of these factors could adversely affect the existing fish populations of the lake.

These adverse changes to Deer Creek and Bass Lake habitats under Option 2 of the No Project/Current Basin Plan Alternative would contribute to a **significant** adverse impact to area biological resources, relative to existing conditions and conditions under the Proposed Project.

9.7.2.3.2.3 *Hazards and Hazardous Materials*

As discussed under Section 9.7.2.1, implementation of Option 2 of the No Project/Current Basin Plan Alternative would require additional transport and storage of

chemicals at the DCWWTP, relative to existing conditions and conditions under the Proposed Project. However, based on the relative degree of additional transportation and storage required and the specific chemicals involved, this would constitute a **less-than-significant impact**.

9.7.2.3.2.4 Hydrology

Option 2 of the No Project/Current Basin Plan Alternative would have both positive and negative effects on regional hydrology.

Under Option 2, flow rates in Deer Creek would be significantly reduced during much of the May through October period, annually, relative to existing conditions and conditions under the Proposed Project. Effluent discharges from the DCWWTP constitute a major source of water to Deer Creek, downstream of the DCWWTP, during this period of the year. Moreover, this source of flow is critical to sustaining the creek's hydrology, groundwater recharge, and associated biological resources in downstream reaches, during the May through October period. Elimination of effluent discharges to Deer Creek during the May through October period under Option 2 of the No Project/Current Basin Plan Alternative would constitute a **significant** adverse impact to Deer Creek hydrology, relative to existing conditions and to conditions under the Proposed Project.

Conversely, increasing reuse under Option 2 could potentially have a positive impact on local water supplies. Increasing the amount of water reuse for agriculture, urban irrigation, and industrial use, could result in a decreased raw water supply demand for these uses. Reduced diversion demand could extend the capability of raw water supplies to meet other, more sensitive uses such as household uses. This could create more reliable, less expensive water supplies for local consumers. At the same time, expanded water supplies due to reuse could reduce the reliance on groundwater supplies, preventing groundwater overdraft. Likewise, on a larger scale, if the District requires less local water supplies due to increased water reuse, more supplies will be available for instream uses downstream of this District's diversion locations. Thus, Option 2 of the No Project/Current Basin Plan Alternative would constitute a **beneficial impact** to District water supplies and the hydrology of the systems from which the District currently diverts its raw water supplies.

9.7.2.3.2.5 Recreation

As initially discussed under aesthetics, elimination of effluent discharges from the DCWWTP to Deer Creek during the May through October period would substantially reduce downstream Deer Creek flows, the amount and quality of both aquatic and riparian habitats, and potential swimming, boating, wading, and fishing opportunities during these months. Moreover, such changes would have adverse effects on the existing populations of organisms using the creek and its riparian corridor during this period of the year (SWRCB 1995).

The anticipated loss and degradation of instream and riparian habitats of Deer Creek would result in adverse effects on creek aesthetics and populations of aquatic and terrestrial organisms. Picnicking and wildlife viewing may be less rewarding due to

lower water levels and subsequent reduction in aquatic biological communities. The substantially reduced flows would result in fewer and shallower downstream pool habitats and associated reductions in potential swimming, boating, wading, and fishing opportunities within the creek, downstream of the DCWWTP. These effects under Option 2 of the No Project/Current Basin Plan Alternative would cause **significant** adverse impacts to recreation in and along the creek, relative to existing conditions and conditions under the Proposed Project.

9.7.2.3.2.6 Water Quality

Option 2 of the No Project/Current Basin Plan Alternative would substantially reduce creek flows downstream of the DCWWTP by eliminating effluent discharge during the May through October period. This Option would be expected to have both positive and negative impacts to water quality, relative to existing conditions and conditions under the Proposed Project.

The positive impacts to water quality would include elimination of certain constituent loading to Deer Creek that result from discharging tertiary treated effluent. However, because constituent loading from the DCWWTP currently does not adversely affect downstream beneficial uses of the creek, reductions in current loadings would not provide demonstrable positive effects to any environmental resources or downstream beneficial uses.

Negative effects to water quality under Option 2 would include elevation in Deer Creek water temperatures in some downstream reaches during the summer and fall months, where flows would become very low. As stated above, a creek having low flow gains heat more rapidly during the summer months than does a creek with higher flows, all else remaining the same. In addition, State Board Order WR 95-9 concluded that returning Deer Creek to its natural state by eliminating effluent discharge would create a potential for toxicity to fish due to decreased water quality (SWRCB 1995).

Converting Bass Lake to a reclaimed water storage facility could potentially impact lake water quality due to nutrient loading associated with the storage of recycled water in the lake. This could result in algal blooms and macrophyte growth, which could further degrade lake water quality during times when large-scale plant die-off occurs. Copper sulfate treatment of Bass Lake could become necessary to control problem algal growth. This would load copper to the system, which, if performed regularly for prolonged periods, could degrade lake water quality and contribute to sediment copper toxicity.

Overall, elimination of effluent discharge to Deer Creek, which is proposed under Option 2 of the No Project/Current Basin Plan Alternative, would constitute a **potentially significant impact** to Deer Creek water quality. Moreover, Option 2 would result in a significant impact to water quality of Bass Lake, relative to existing conditions and conditions under the Proposed Project.

9.7.3 Option 3 – Connect to SRWTP

9.7.3.1 Description

Under Option 3 (Connect to SRWTP), the District would maintain its current level of effluent recycling and re-route the remaining effluent and/or raw sewage to SRWTP via pipeline. The facilities necessary to accomplish this option are to build pump stations and pipelines from Cameron Park to the available trunk line sewer locations. Two trunk line sewer options are viable: 1) gravity flow via Deer Creek drainage course; and 2) pump and gravity flow via Folsom trunk lines.

9.7.3.1.1 Gravity

This option consists of a trunk line that SRWTP plans to build that follows the Deer Creek drainage course. The Deer Creek trunk line is scheduled to be completed in 16-18 years and will likely involve significant environmental scrutiny. If this option were selected, a gravity sewer would be built from the Deer Creek plant down the Deer Creek drainage plain to the terminus of the Sacramento trunk line.

9.7.3.1.2 Pumped and Gravity

The second option consists of a connection to the Sacramento County system in Folsom. Trunk lines have recently been built to service the City of Folsom. A pump station would be constructed in the vicinity of Cameron Park where the gravity sewers cross Highway 50. Some interconnecting sewers from the Sanitation District 2 system would have to be tied into the pump station. Sewage would be pumped along Highway 50 to El Dorado Hills, then diverted to follow the contours along White Rock Road to Prairie City Road, and then north to tie into the trunk sewer. The pump station would have to be able to pump the entire peak flow and would include standby power to assure compliance in the event of a power failure.

Costs for implementation of the Option 3, including both District facility costs and connection fees to SRWTP would be approximately \$38 to 52 million. Facility costs would include the pump station and approximately 15 miles of sewer pipeline.

9.7.3.2 Implementation Considerations

Option 3 (Connection to SRWTP) would require the District to return Deer Creek to its natural state by eliminating all effluent discharges to the creek. This could not be accomplished absent addressing, in some manner, Order WR 95-9. Thus, if a change to this order were to be sought, methods for obtaining such change would need to be investigated and evaluated. If year-round discharges to Deer Creek cannot be ceased, this option would be infeasible. In addition, the District would have to be annexed, or execute an agreement with the Sacramento County Regional Sanitation District (SRCSD) to transport and treat sewage. SRCSD has indicated that a facility connection fee would have to be paid, similar to any other customer.

9.7.3.3 Environmental Impacts

Implementation of Option 3 (Connection to SRWTP) of the No Project/Current Basin Plan Alternative would not eliminate any significant adverse impacts of the Proposed Project because there are none.

Potential environmental impacts associated with Option 3 would fall into two main categories: 1) short-term, construction-related impacts; and 2) long-term, operations-related impacts. Based on the above discussions, it can be reasonably concluded that both short-term construction and long-term operational activities associated with Option 3 of the No Project/Current Basin Plan Alternative would have **no impacts** to the following resources:

- Agricultural Resources;
- Geology and Soils;
- Hazards and Hazardous Materials;
- Land Use and Planning;
- Mineral Resources;
- Population and Housing;
- Public Services; and
- Utilities and Service Systems.

Conversely, construction-related activities associated with Option 3 of the No Project/Current Basin Plan Alternative could potentially have impacts to:

- Air Quality;
- Noise;
- Cultural Resources; and
- Transportation/Traffic.

Furthermore, additional discharge of secondary treated effluent from the SRWTP facility into the Sacramento River, rather than discharge of tertiary treated effluent into Deer Creek, under Option 3 could potentially have long-term impacts to:

- Aesthetics;
- Biological Resources;
- Hydrology;
- Recreation; and
- Water Quality.

Potential short-term construction-related impacts and long-term impacts resulting from Option 3 of the No Project/Current Basin Plan Alternative are discussed separately below.

9.7.3.3.1 Construction-related Impacts

To consistently comply with the current Basin Plan objectives for temperature under Option 3 of the No Project/Current Basin Plan Alternative, the influent from the Deer Creek service area would be routed to SRWTP for treatment and discharge to the

Sacramento River. This option would eliminate discharge to Deer Creek year-round. Construction and operation of new facilities at DCWWTP, and elsewhere off site, would be required. See Section 9.7.3.1 for a detailed description of these facilities.

On-site construction activities would be conducted in a manner (i.e., using BMPs) that would result in less-than-significant impacts to local and onsite resources. Some of the necessary facilities (e.g., pipelines) would be constructed outside the current site plan or “footprint” of DCWWTP. As such, off-site land disturbances and/or clearing would occur. Construction BMPs would be implemented to minimize and/or avoid impacts to resources resulting from both on-site and off-site construction activities. Consequently, potential construction-related impacts to all resource categories would be reduced to **less-than-significant** levels or completely avoided, with the possible exceptions of impacts to air quality, cultural resources, noise, and transportation/traffic.

9.7.3.3.1.1 Air Quality, Noise, and Transportation/Traffic

Potential air quality, noise, and transportation/traffic impacts are all associated with transportation of workers, equipment, and supplies to and from construction sites, and operation of equipment both on- and off-site during the construction period. These transportation and construction activities would temporarily increase air pollution, local traffic, and noise levels, particularly within several miles of construction areas. Increased traffic levels could, foreseeable, increase environmental exposure to hazardous materials (e.g., fuels, oils, lubricants, etc.). Construction BMPs would be implemented to minimize air quality, noise, and transportation/traffic impacts. Because BMPs would be implemented and because effects on these resource areas would be temporary, construction-related impacts to air quality, noise, and transportation/traffic under Option 3 of the No Project/Current Basin Plan Alternative would be **less-than-significant**.

9.7.3.3.1.2 Cultural Resources

Option 3 of the No Project/Current Basin Plan Alternative would involve placement of collection system pipelines and other off-site construction activities. These activities have the potential to adversely affect buried cultural resources, pending the exact routing of pipelines and locations determined for other construction activities (e.g., interceptors). However, because necessary construction BMPs and best possible routing of pipelines would be implemented to minimize or avoid impacts to buried artifacts and other cultural resources, this impact would be **less than significant**.

9.7.3.3.2 Operations-related Impacts

9.7.3.3.2.1 Aesthetics

As a means of compliance with the current Basin Plan objectives for temperature, Option 3 of the No Project/Current Basin Plan Alternative proposes to eliminate discharge to Deer Creek year-round. DCWWTP service area influent would be routed to the SRWTP for treatment and discharge as secondary effluent to the Sacramento River. Elimination of effluent discharges from the DCWWTP to Deer Creek during the

late spring, summer, and early fall periods (e.g., May through October) would result in the following changes to Deer Creek:

- significantly reduced flows rates (SWRCB 1995);
- reduced amounts of downstream habitat for aquatic organisms (SWRCB 1995);
- elevated downstream water temperatures (because creeks having lower flows gain heat more rapidly during summer months, all else being equal);
- reduced acreage of riparian habitat and associated wildlife species utilizing the riparian corridor (SWRCB 1995); and
- fewer and shallower downstream pool habitats and associated reductions in the potential for swimming and boating opportunities.

No impacts to aesthetics would be expected due to ceasing effluent discharge during the winter period, because precipitation-derived runoff constitutes the primary source of instream flows during the winter/early spring precipitation period of the year. Hence, reductions in creek flows under Option 3 during the precipitation period of the year would generally be rather minor.

Based on changes to Deer Creek that would primarily occur during the summer and fall periods, Option 3 of the No Project/Current Basin Plan Alternative would cause **significant** adverse impacts to the aesthetics and aesthetic enjoyment of Deer Creek, relative to existing conditions and conditions under the Proposed Project.

9.7.3.3.2 Biological Resources

Elimination of effluent discharges from the DCWWTP to Deer Creek throughout the year would result in significant adverse changes to Deer Creek's aquatic and riparian habitats as discussed above and in State Board Order WR 95-9 (SWRCB 1995), which imposes a condition to approval of the District's treated wastewater change petition WW-20 requiring minimum effluent discharges to Deer Creek. Order WR 95-9 states that the condition was imposed to protect and maintain Deer Creek's aquatic and riparian communities fostered, in part, by DCWWTP effluent discharges. Ceasing effluent discharge to the creek throughout the year would negatively impact Deer Creek's aquatic biological resources in downstream reaches. Ceasing summer and fall discharges to Deer Creek would be expected to significantly reduce the miles of wetted habitat present during these periods of the year, downstream of the DCWWTP and, therefore, the number of miles of riparian habitat supported by the creek (SWRCB 1995). Moreover, the aquatic habitat that would persist for a few miles below the DCWWTP during summer and fall would be substantially reduced in quality for sustaining fish populations and other aquatic communities (SWRCB 1995).

Ceasing effluent discharges to Deer Creek throughout the year also would cause Deer Creek to lose surface flow continuity with the Cosumnes River earlier in the year. Under Option 3, loss of surface flow continuity would probably occur in May/June compared to June/July under existing conditions and conditions under the Proposed

Project. This would increase the chance that any steelhead, a species listed as threatened under the federal ESA, potentially produced in the creek would become isolated from downstream waters prior to the creek's average water temperatures reaching a level (e.g., about 68°F) that would trigger juvenile steelhead emigration from the creek. Any juvenile steelhead isolated from downstream waters in spring would likely be lost due, either directly or indirectly, to thermal stress during the summer period.

Finally, Option 3 would result in additional discharge of secondary treated effluent from the SRWTP to the Sacramento River. As such, it would further contribute to constituent loadings to the river. The Sacramento River is 303(d) listed as an impaired water body due to elevated Diazinon, mercury, and unknown toxicity. Increasing effluent discharged from this facility could possibly exacerbate any potential adverse effects of water quality on Sacramento River biological resources – both in the mixing zone and farther downstream.

These adverse changes to Deer Creek and the Sacramento River under Option 3 of the No Project/Current Basin Plan Alternative would contribute to a **significant** adverse impact to area biological resources, relative to existing conditions and conditions under the Proposed Project.

9.7.3.3.2.3 Hydrology

Under Option 3, effluent discharges to Deer Creek would cease year-round. Hence, flow rates in Deer Creek, downstream of the DCWWTP, would be significantly reduced during much of the late spring, summer, and fall periods of the year, annually, relative to existing conditions and conditions under the Proposed Project. Effluent discharges from the DCWWTP constitute a major source of water to Deer Creek, downstream of the DCWWTP, during these periods of the year. Moreover, this source of flow is critical to sustaining the creek's instream flows, groundwater recharge, and associated biological resources, during these periods.

Precipitation events and related runoff dominate flows during the winter season. Frequent precipitation events saturate the streambed and surrounding soils so that precipitation rates exceed infiltration rates, resulting in increased runoff and stream flows. Effluent discharges have a much lesser contribution to stream flows during the winter season. Therefore, ceasing effluent discharges to Deer Creek during the winter precipitation season would be expected to have much lesser effects on Deer Creek hydrology compared to ceasing discharges during the summer and fall period of the year.

Based on the above discussion, elimination of effluent discharges to Deer under Option 3 of the No Project/Current Basin Plan Alternative would constitute a **significant** adverse impact to Deer Creek hydrology, relative to existing conditions and relative to conditions under the Proposed Project.

Because of the small volume of influent routed from the DCWWTP to the SRWTP, relative to SRWTP influent flows and Sacramento River flows, treatment and discharge of Deer Creek service area effluent to the Sacramento River would have **less-than-significant** impacts on Sacramento River hydrology.

9.7.3.3.2.4 Recreation

As initially discussed under aesthetics, elimination of effluent discharges from the DCWWTP to Deer Creek would substantially reduce downstream Deer Creek flows during the late spring, summer, and fall periods. This would decrease the amount and quality of both aquatic and riparian habitats, and potential for swimming, boating, wading, and fishing opportunities during summer and fall months. Moreover, such changes would have adverse effects on the existing populations of organisms using the creek and its riparian corridor during this period of the year (SWRCB 1995). Since little recreational activity occurs during the winter, no impacts to recreation would be expected due to ceasing effluent discharge during the winter period.

The anticipated loss and degradation of instream and riparian habitats of Deer Creek would result in adverse effects on creek aesthetics and populations of aquatic and terrestrial organisms. Picnicking and wildlife viewing may be less rewarding due to lower water levels and subsequent reduction in aquatic and riparian biological communities. The substantially reduced flows would result in fewer and shallower downstream pool habitats and associated reductions in potential swimming, boating, wading, and fishing opportunities within the creek, downstream of the DCWWTP. These effects under Option 3 of the No Project/Current Basin Plan Alternative would cause **significant** adverse impacts to recreation in and along the creek, relative to existing conditions and conditions under the Proposed Project.

Because the additional influent routed to SRWTP under this option would constitute a very minor percentage (e.g., <2%) of SRWTP's current influent, and because the Sacramento River provides a high level of dilution, its treatment and discharge to the Sacramento River would have **less-than-significant** impacts to recreation in and along the Sacramento River.

9.7.3.3.2.5 Water Quality

Option 3 of the No Project/Current Basin Plan Alternative would substantially reduce Deer Creek flows during the late spring, summer, and fall periods, downstream of the DCWWTP, by eliminating effluent discharge to the creek, year-round. This Option would be expected to have both positive and negative impacts to water quality, relative to existing conditions and relative to conditions under the Proposed Project.

The positive impacts to water quality would include elimination of certain constituent loading to Deer Creek that results from discharging tertiary treated effluent. However, because current constituent loading from the DCWWTP does not adversely affect downstream beneficial uses of the creek, reductions in current loadings would not provide demonstrable positive effects to any environmental resources or downstream beneficial uses.

Negative effects to water quality under Option 3 would include elevation in Deer Creek water temperatures in some downstream reaches during the summer and fall months, where flows would become very low. This would occur because a creek having low flow gains heat more rapidly during the summer months than does a creek with higher flows, all else remaining the same. Elevated water temperatures in some reaches of the creek could have adverse impacts to fish and benthic macroinvertebrate populations using these reaches. In addition, State Board Order WR 95-9 concluded that reduction in current surface flows in Deer Creek would create a potential for toxicity to fish due to decreased water quality (SWRCB 1995).

A second negative effect to water quality would result from discharging the Deer Creek service area effluent to the Sacramento River as secondary effluent under this option, versus discharging the same influent as tertiary treated effluent into Deer Creek as occurs under existing conditions and as would occur under the Proposed Project. Albeit to a very small degree, this would incrementally increase constituent loadings (e.g., suspended and dissolved solids, solid-adsorbed contaminants) to the Delta because of the lower levels of treatment.

Overall, operations under Option 3 of the No Project/Current Basin Plan Alternative would constitute a **Potentially significant** impact to water quality, relative to existing conditions and conditions under the Proposed Project.

9.7.4 Cumulative Impacts of the No Project Alternative Options

Cumulative impacts refer to one or more individual effects which, when taken together, are considerable or which compound or increase other environmental impacts. Such effects result from the incremental impact of a project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period-of-time.

As discussed above, Option 1 (Additional Treatment Facilities) of the No Project/Current Basin Plan Alternative would not result in any significant environmental impacts, and would be protective of Deer Creek's beneficial uses influenced by creek temperature. Moreover, it would not incrementally contribute to any known cumulative impacts to identified resources.

As discussed above, Option 2 (Effluent Reuse) of the No Project/Current Basin Plan Alternative would result in significant environmental impacts to Deer Creek aesthetics, biological resources, hydrology, recreation, and water quality of Bass Lake and Deer Creek, relative to existing conditions and conditions under the Proposed Project. As such, Option 2 could incrementally contribute to potential cumulative impacts to these same resources. Consequently, implementation of Option 2 would constitute **significant cumulative impacts** to Deer Creek aesthetics, biological resources, hydrology, and recreation. Moreover, implementation of Option 2 would constitute a

potentially significant cumulative impact to biological resources within El Dorado and Sacramento Counties, and Deer Creek water quality.

The significant impacts identified for Option 3 (Connect to SRWTP) of the No Project/Current Basin Plan Alternative include significant impacts to Deer Creek aesthetics, biological resources, hydrology, recreation, and water quality of Deer Creek. These impacts were primarily the result of ceasing discharge of treated effluent to Deer Creek year-round, relative to existing conditions. Option 3 could incrementally contribute to potential cumulative impacts to these same resources of Deer Creek and the region. Consequently, implementation of Option 3 would constitute **significant cumulative impacts** to Deer Creek aesthetics, biological resources, hydrology, and recreation. Moreover, its implementation would constitute a **potentially significant cumulative impact** to biological resources within El Dorado and Sacramento Counties, and Deer Creek water quality.

9.8 RECOMMENDED ALTERNATIVE

Based on the analysis of the Proposed Project and each of the three options under the No Project/Current Basin Plan Alternative presented above, Regional Board staff recommend approval and implementation of the Proposed Project.

9.9 DE MINIMIS FINDING

The Regional Board staff, after consideration of the evidence, recommend that the Regional Board find that the Proposed Project has no potential for adverse effect, either individually or cumulatively, on wildlife, consistent with Fish and Game Code Section 711.2 and Section 711.4.

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APPENDICES

APPENDIX A

HISTORICAL PERSPECTIVE ON THE DEVELOPMENT OF WATER QUALITY CRITERIA, WITH SPECIFIC ADDRESS OF TEMPERATURE CRITERIA

HISTORIC OVERVIEW ON THE DEVELOPMENT OF AMBIENT WATER QUALITY CRITERIA

The genesis of water quality criteria in the United States began in the early 1900s, with the publication of technical documents identifying the effects of contaminants and pollution on fish. Ellis (1937) published the first “review document” describing the effects of numerous substances on aquatic life. In 1952, the State of California published a 512-page book on “water quality criteria” associated with eight beneficial uses of water. Concentration-effect levels for various contaminants were discussed for each of the designated uses. This document was edited and greatly expanded into a second edition in 1963 (McKee and Wolf 1963). This second edition marked the first comprehensive effort of bringing together, under one cover, the world’s scientific literature on water quality criteria for the protection of stated beneficial uses, including the protection of freshwater aquatic life.

In 1966, the Secretary of the Interior appointed a number of nationally recognized scientists to a National Technical Advisory Committee to develop water quality criteria for five (5) specified uses of water, including: domestic water supply, recreation, fish and wildlife, agricultural, and industrial (USEPA 1976). The report, which has become known as the “Green Book”, was published in 1968 by the Federal Water Pollution Control Administration (FWPCA 1968), and was reprinted in 1972 by the U.S. EPA. The Green Book was the first water quality criteria document that developed *recommendations*, involving professional judgments, based on the scientific literature. Its publication marked a distinct change in the development and use of water quality criteria from one of simply compiling available concentration-effect data to one that recommended specific concentrations that, when met, would ensure the protection of the quality of the environment and the continuation of the designated beneficial use (USEPA 1976).

The U.S. EPA contracted with the National Academy of Sciences and the National Academy of Engineering to expand and improve upon the concept brought forth in the Green Book, and to update the scientific basis upon which water quality criteria were based. The result of this effort was a 1973 publication that presented water quality criteria as of 1972 (USEPA 1973). This water quality criteria document has become known as the U.S. EPA’s “Blue Book.” Since publishing its Blue Book on water quality criteria in 1973, the U.S. EPA published updates to this document in 1976 (USEPA 1976), referred to as the “Red Book”, and in 1986 (USEPA 1986), referred to as the “Gold Book.”

This brief history of the development of water quality criteria in the United States is provided because technical review and discussion of these documents in this report: 1) illustrates where water quality objectives for temperature that appear in the current Basin Plan likely came from; and 2) identifies the extent to which current Basin Plan objectives are consistent with past and present national criteria for these same parameters. Understanding the technical origin of current Basin Plan objectives for the above-mentioned parameters, as well as their current technical defensibility based on

the scientific weight-of-evidence regarding physiological requirements of freshwater aquatic life (particularly for species occurring in Deer Creek), provides an appropriate scientific and regulatory basis from which to propose site-specific water quality objectives for Deer Creek.

EVOLUTION OF THE TECHNICAL CONCEPTS AND APPROACH TO DEVELOPING TEMPERATURE CRITERIA TO PROTECT FRESHWATER AQUATIC LIFE

McKee and Wolf (1963) provided a brief review of the literature on temperature effects on aquatic life, but presented no recommendations or criteria for the control of temperature in water bodies. This report did, however, introduce the concept of regulating temperatures by controlling *changes* in temperature from “normal” conditions. Basing regulatory recommendations on this concept, as well as an additional concept that species- and life-stage-specific maximum temperatures should not be exceeded, the Federal Water Pollution Control Administration recommended that the temperature of a water body should not be increased by more than 5°F during any month of the year, nor should the addition of heat be allowed that would result in exceeding maximum temperatures tolerated by important species (FWPCA 1968).

In its 1972 water quality criteria document (USEPA 1973), the U.S. EPA clearly stated its revised “technical philosophy” with regard to regulating temperatures for the protection of aquatic life. The concept of regulating temperatures by controlling *changes* from the normal ambient temperature (via defining requirements such as the 5°F delta stated above) was refuted by the U.S. EPA as being technically inappropriate, as it would not provide adequate protection for some species at some times, but could be unnecessarily conservative for those same species at other times. From publication of its 1972 water quality criteria (USEPA 1973) through the present (see USEPA 1986), the U.S. EPA has promoted development of site-specific temperature criteria that:

- 1) define maximum temperature limits for sustained or long-term (e.g., 7 days or longer) thermal protection;
- 2) define maximum temperature limits for short-term thermal protection (e.g., hours or days);
- 3) define limits for the reproductive period that meet specific site requirements for successful migration, spawning, egg incubation, fry rearing, and other reproductive functions of important species;
- 4) maintain, to a protective level, daily and seasonal temperature regimes; and
- 5) maintain and protect diverse species assemblages and aquatic communities characteristic of the water body.

Collectively, the limits established should be protective of important aquatic species present in the water body, and should preserve community-level structure and function. Thermal criteria also must be formulated with knowledge of how man alters temperatures, and how the biota can reasonably be expected to respond to the thermal regimes produced. The environmental situations of aquatic organisms (e.g., where they

are, when they are there, in what numbers) also must be understood and accounted for in criteria development. Thermal criteria for migratory species should be applied to a certain area only when the species is actually there (USEPA 1973). The use of “delta” requirements to regulate temperatures in aquatic systems is not consistent with, nor is it supported by, the U.S. EPA’s current national water quality criteria for temperature (USEPA 1986).

The approach to calculating the maximum temperatures for sustained or long-term exposures has evolved, to some degree, in recent decades. As part of its 1972 criteria, the U.S. EPA recommended use of the following equation (USEPA 1973):

Equation 1: optimum temp.+ $\frac{(\text{ultimate upper incipient lethal temp.}) - (\text{optimum temp.})}{3}$

where: optimum temperature = that supporting maximum growth rates
ultimate upper incipient lethal temperature = the highest temperature that could be tolerated indefinitely by about 50% of the experimental animals after maximum acclimation to heat (Doudoroff 1957).

This formula offered a practical method for calculating allowable chronic (e.g., maximum weekly) limits for important species (see USEPA 1973, Table III-12). This same conceptual approach for deriving species-specific maximum temperature limits for chronic exposures has been presented as part of the U.S. EPA’s temperature criteria in 1976 (USEPA 1976) and 1986 (USEPA 1986).

Development of maximum temperature limits for short-term exposures are to be based on the incipient lethal temperatures and application of a safety factor for important aquatic species present in a given water body (USEPA 1973, 1976, 1986). The equation recommended by the U.S. EPA in 1972 for calculating short-term maximum temperatures for a given species is provided below (USEPA 1973):

Equation 2: $1 \geq \frac{\text{time}}{10^{[a+b(\text{temp.}+2)]}}$

Where time is expressed in minutes, temperature in degrees centigrade, and where values for a and b are intercept and slope, respectively, which are characteristics of each acclimation temperature for each species (see USEPA 1973, Appendix II-C). This same technical concept has been maintained by the U.S. EPA in its temperature criteria published in 1976 (USEPA 1976) and 1986 (USEPA 1986).

In its review of the EPA Red Book, AFS (1979) was critical of the EPA’s temperature criteria development guidelines described above. This criticism was not targeted at the technical concepts or principles as much as it was specific factors such as: 1) inadequate data available to make effective use of the proposed equations; 2) use of ambiguous terminology; 3) absence of clear descriptions of the manner and location in which developed criteria are to be applied (e.g., plume vs. mixed river below point-

source discharges); and 4) 2°F safety factor insufficient for adequate protection of species. In fact, AFS (1979) stated that *“The use of the ultimate upper incipient lethal temperature and the physiological optimum temperature (for growth) as bases for developing a criterion for prolonged exposure to elevated temperature is attractive in principle.”* The one primary technical concerns with the U.S. EPA's approach was that it may not adequately account for food availability and fish size when calculating the maximum temperature limit for prolonged exposures (AFS 1979).

APPENDIX B

RECOMMENDED FORMAT FOR COMMENT LETTERS

Comment letters to the Regional Board on staff recommendations serve two purposes: (1) to point out areas of agreement with staff recommendations; and (2) to suggest revisions to staff recommendations. Clear statements of both areas of agreement and suggested revisions will assist the Regional Board and staff in understanding the recommendations of the commenter. The California Environmental Quality Act requires staff to respond to those comments submitted by the public that suggest revisions to staff recommendations, as long as those comments concern revisions to the Basin Plan Amendment. In order to aid staff in identifying suggested revisions and to respond to the specific concerns of the commenter, the following format for comment letters is suggested.

FORMAT FOR COMMENTS SUGGESTING REVISIONS

The suggested format is to number to the comment, state in one sentence the topic upon which the comment is directed, provide a supporting argument, and make a recommendation. Supporting arguments which include citations will assist staff in considering the comment. Below is an example.

The Environmental Action Team (EAT) recommends the following revision to staff recommendations:

1. Proposed Xenon objective for Slug Slough

Staff has recommended a 0.001 ng/L Xenon objective to protect resident guppies in slug Slough. The U.S. EPA Xenon criteria for protection of guppies in fresh waters is currently 0.0001 ng/L – an order of magnitude lower than the staff recommendation. The U.S. EPA criteria is supported by several studies in peer reviewed journals (e.g., Smith and Jones; J. Env. Qual. (1994); Johnson; J. Env. Qual. (1995)). Staff argues that the cost of analyzing for Xenon in water below 0.001 ng/L is prohibitive does not support the adoption of a water quality that is not protective of beneficial uses. More cost effective analytical procedures may be developed in response to the need for more intensive Xenon analysis. EAT, therefore, strongly recommends the adoption of a 0.0001 ng/L Xenon objective to fully protect guppies in Slug Slough.

FORMAT FOR COMMENTS SUPPORTING STAFF RECOMMENDATIONS

If the commenter concurs with a staff recommendation, a statement to that effect will assist the Regional Board in determining what action, if any, to take on the staff recommendation. In general, no supporting discussion need be presented, unless the commenter feels that the staff recommendation could be further enhanced or clarified. Below is an example.

1. Proposed Neon objective for Slug Slough

EAT strongly supports the adoption of the 0.05 pg/L Neon objective proposed by staff for Slug Slough. In addition to arguments presented by staff, it should be pointed out that

Harrison's recent work on goldfish (Harrison, et al, 1996) confirms the appropriateness of the proposed objective for the protection of fresh water aquatic life.

APPENDIX C

CHARACTERIZATION OF SEASONAL TEMPERATURE REGIMES OF DEER CREEK

Topics Addressed

DAILY MAXIMUM AND DAILY AVERAGE CREEK TEMPERATURES

MONTHLY AVERAGE CREEK TEMPERATURES

DIURNAL FLUCTUATIONS IN DEER CREEK TEMPERATURE

List of Figures

Figure C-1. Daily maximum Deer Creek temperatures at the R1 (upstream) monitoring location. Plotted values are all available data from the District's hourly data set for the period September 9, 1997 to July 9, 2001, and from the District's discharge monitoring reports for 1992 (a critical year).

Figure C-2. Daily maximum Deer Creek temperatures at the R2 (downstream) monitoring location. Plotted values are derived from the District's hourly data set for the period September 9, 1997 to July 9, 2001 via mass-balance calculations using measured R1 and effluent temperatures and flows.

Figure C-3. Daily average Deer Creek temperatures at the R1 station (upstream) monitoring location. Plotted values are derived from the District's hourly data set for the period September 9, 1997 to November 29, 2000.

Figure C-4. Daily average Deer Creek temperatures at the R2 station (downstream) monitoring location. Plotted values are derived from the District's hourly data set for the period September 9, 1997 to July 9, 2001 via mass-balance calculations using measured R1 and effluent temperatures and flows.

Figure C-5. Monthly average Deer Creek temperatures at the R1 (upstream) and R2 (downstream) monitoring locations. Plotted values are derived from the District's hourly data set for the period September 9, 1997 to July 9, 2001. R2 values plotted are monthly means of values determined via mass-balance calculations using measured R1 and effluent temperatures and flows.

Site-specific data characterizing the seasonal temperature regimes of Deer Creek, above and below the DCWWTP, are summarized below.

DAILY MAXIMUM AND DAILY AVERAGE CREEK TEMPERATURES

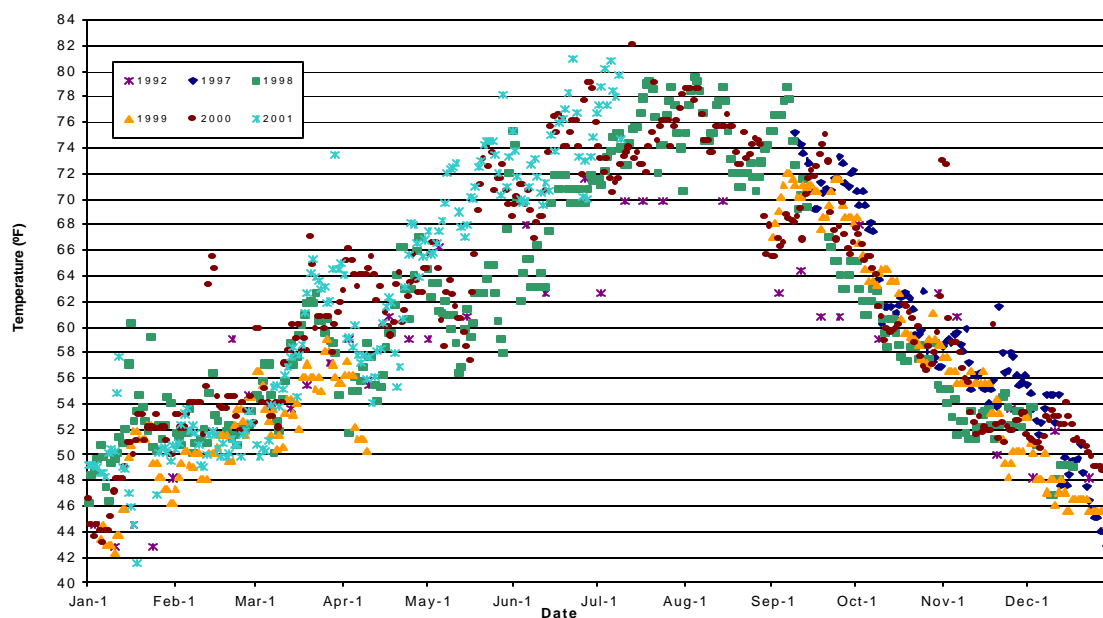


Figure C-1. Daily maximum Deer Creek temperatures at the R1 (upstream) monitoring location. Plotted values are all available data from the District's hourly data set for the period September 9, 1997 to July 9, 2001, and from the District's discharge monitoring reports for 1992 (a critical year).

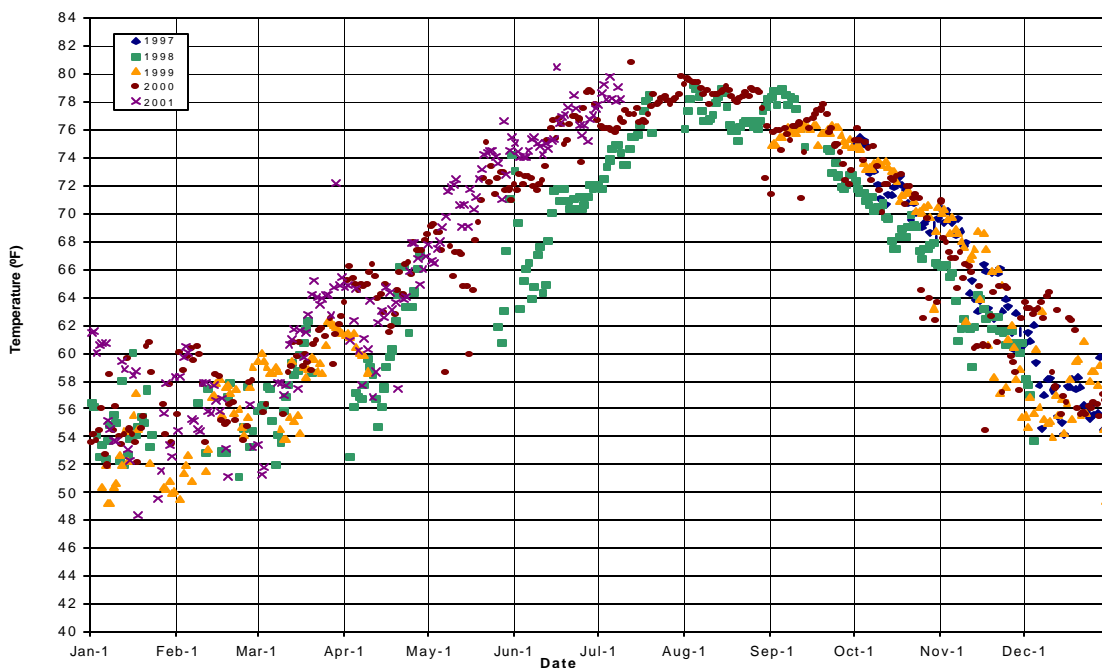


Figure C-2. Daily maximum Deer Creek temperatures at the R2 (downstream) monitoring location. Plotted values are derived from the District's hourly data set for the period September 9, 1997 to July 9, 2001 via mass-balance calculations using measured R1 and effluent temperatures and flows.

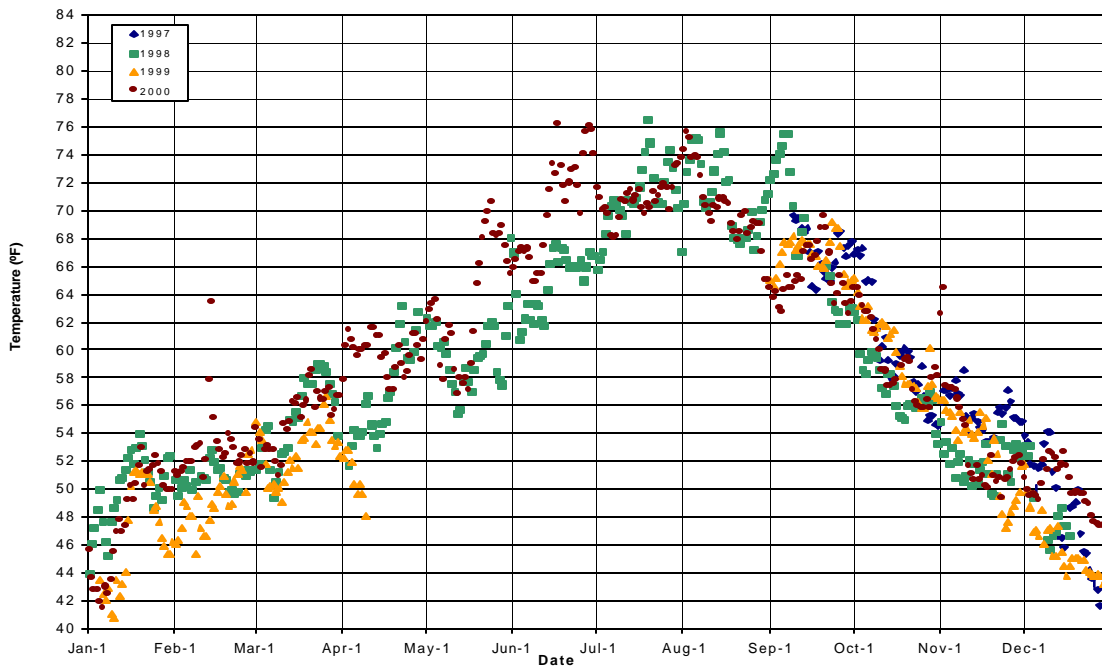


Figure C-3. Daily average Deer Creek temperatures at the R1 station (upstream) monitoring location. Plotted values are derived from the District's hourly data set for the period September 9, 1997 to November 29, 2000.

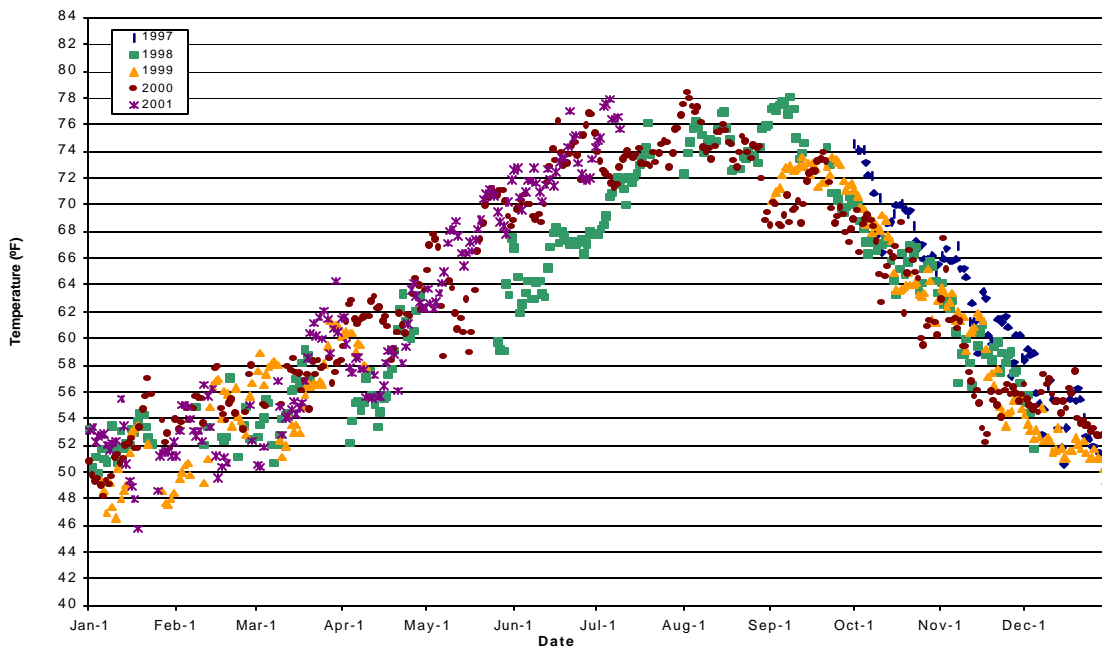


Figure C-4. Daily average Deer Creek temperatures at the R2 station (downstream) monitoring location. Plotted values are derived from the District's hourly data set for the period September 9, 1997 to July 9, 2001 via mass-balance calculations using measured R1 and effluent temperatures and flows.

MONTHLY AVERAGE CREEK TEMPERATURES

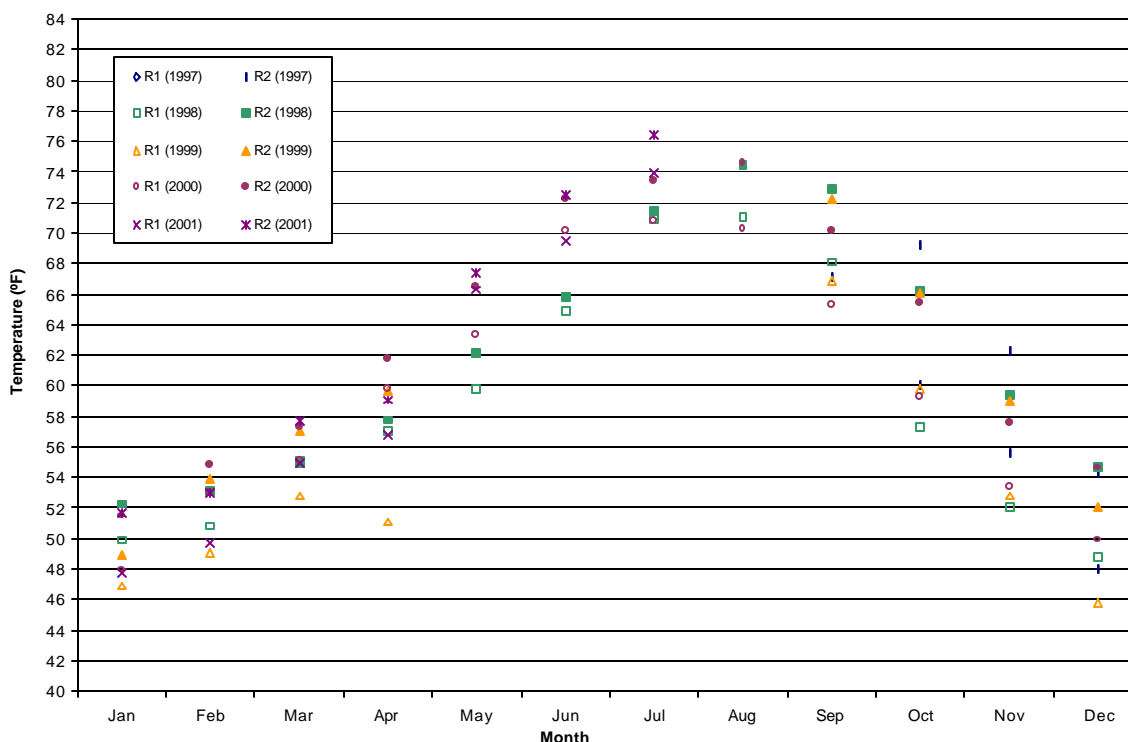


Figure C-5. Monthly average Deer Creek temperatures at the R1 (upstream) and R2 (downstream) monitoring locations. Plotted values are derived from the District's hourly data set for the period September 9, 1997 to July 9, 2001. R2 values plotted are monthly means of values determined via mass-balance calculations using measured R1 and effluent temperatures and flows.

DIURNAL FLUCTUATIONS IN DEER CREEK TEMPERATURE

Diurnal fluctuations in Deer Creek water temperature are primarily driven by diurnal fluctuations in ambient air temperature. Because the diurnal fluctuation in ambient air temperatures in the vicinity of the DCWWTP is often as much as 30-40°F (16.5-22°C) during the summer months, and because the Deer Creek flow rate upstream of the DCWWTP is low at this time of year (i.e., often less than 1 cfs or about 0.6 mgd), diurnal fluctuations in Deer Creek water temperature upstream of the DCWWTP are large throughout the summer period. For example, *in situ* measurements during the period June 27 through July 31, 1997 indicated that Deer Creek temperature at the R1 (upstream) location varied diurnally by 6.3°F (3.5°C) to 15°F (8.3°C), with an average diurnal variation of 12.7°F (7°C). Diurnal changes in creek temperature at the R2 (downstream) location ranged from 5°F (3°C) to 13°F (7°C), with an average diurnal variation of 9°F (5°C) (SWRI 1997). Available data indicate that diurnal fluctuations in

Deer Creek water temperature at the R1 location are generally greatest during the months of July and August and lowest during the month of February.

APPENDIX D

TEMPERATURE REQUIREMENTS OF FRESHWATER AQUATIC LIFE

Topics Addressed

EFFECTS OF TEMPERATURE ON AQUATIC LIFE

RANGE OF TOLERABLE TEMPERATURES

INFLUENCE OF TEMPERATURE ON HABITAT SELECTION BY FISH

EFFECTS OF RAPID TEMPERATURE CHANGE ON AQUATIC LIFE

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Fish Community

Benthic Macroinvertebrate Community

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Table D-3. Thermal tolerance information for dominant taxa of benthic macroinvertebrates found in Deer Creek upstream of the DCWWTP's point of effluent discharge.

EFFECTS OF TEMPERATURE ON AQUATIC LIFE

The rate of metabolism in poikilothermic (i.e., cold-blooded) animals depends on temperature. Consequently, water temperature imparts numerous direct physiological and behavioral effects on fish and benthic macroinvertebrates. Among the most significant of these effects is the direct regulation of development, particularly during early life stages. Water temperature and photoperiod (i.e., day length) act together as the primary factors dictating the schedule upon which key life cycle activities such as migration, reproduction, and growth occur annually for populations of fish and macroinvertebrates.

In addition to such direct effects, an elevation in water temperature can exert indirect effects on fish and macroinvertebrates by increasing their oxygen demand while simultaneously diminishing the solubility of dissolved oxygen in water. Hence, the demand for oxygen increases under conditions where the supply decreases (McKee and Wolf 1963).

The sections below discuss specific types of effects of temperature and temperature change on fish, macroinvertebrates, and aquatic plants.

RANGE OF TOLERABLE TEMPERATURES

Several bibliographic references pertaining to the effects of temperature on aquatic life have been compiled (e.g., Kennedy and Mihursky 1967; Raney and Menzel 1969; Alabaster and Lloyd 1980). Unlike with pH and turbidity, for which general ranges can be defined that are (with few exceptions) protective of all freshwater aquatic life, acceptable temperature ranges cannot be defined in this manner. This is because maximum tolerable temperatures (i.e., upper and lower limits) that fish and macroinvertebrates can tolerate depend upon: 1) species; 2) life stage; 3) prior acclimation temperature and thermal history; 4) duration of exposure; 5) oxygen availability; and 6) the synergistic effects of any toxicants present (Doudoroff 1957; McKee and Wolf 1963; USEPA 1973; Alabaster and Lloyd 1980). For example, a rise of 9-11°F (5-6°C) is detrimental to pike embryos; however, the majority of cyprinids tolerate an increase of 14-18°F (8-10°C) during embryonic development.

Juvenile and adult fish generally can tolerate a wider range of temperature than embryos (Alabaster and Lloyd 1980). For many cyprinids, the permissible increase of temperature is about 11°F (6°C) above natural ambient values, with an upper limit of approximately 86°F (30°C) during the warmest period. For salmonids such as rainbow trout, 68-70°F (20-21°C) has often been identified as the upper permissible temperature during the warmest period of the year (Alabaster and Lloyd 1980).

Rainbow trout in ponds and raceways did not respond to temperature changes between 52°F and 64°F (11-18°C) (Alabaster and Lloyd 1980). The range of temperature that is acceptable to even a single species can vary significantly by season and due to numerous other environmental, physiological, and behavioral factors. Most importantly,

the *resultant absolute* temperature typically is the primary factor dictating effects on aquatic life. In the above example, rainbow trout had no response to a 12°F increase in temperature between 52°F and 64°F. This is because both the 52°F starting temperature and the 64°F resulting temperature are both within the range of acceptable rearing temperatures for adult and juvenile rainbow trout. However, rainbow trout would most certainly show effects for a equal 12°F change from 64°F to 76°F because the *resultant absolute* temperature (i.e., 76°F) is approaching this species' upper incipient lethal temperature. For these reasons, no one (or even two or three) temperature range(s) can be defined that would be protective of all aquatic life within a diverse aquatic community. Moreover, defining a single value of *change* in temperature, relative to an ambient starting temperature, cannot be used to effectively regulate temperature of ambient waters because a change of even one degree from an ambient temperature has varying significance for an organism, depending upon where the ambient level lies within the site- and life-stage-specific tolerance range for that organism (USEPA 1973).

For macroinvertebrates, temperature has a direct influence on the timing of various developmental life stages, which, in turn, can affect the timing of emergence. The same mechanisms that define temperature-related effects on fish community composition, structure, and diversity act on macroinvertebrate communities. Changes to a given benthic macroinvertebrate community resulting from alterations in temperature also depend on: 1) species and life stages present; 2) prior acclimation temperature and thermal history; 3) duration of exposure; 4) oxygen availability; and 5) the synergistic effects of any toxicants present (Doudoroff 1957; McKee and Wolf 1963; USEPA 1973; Alabaster and Lloyd 1980). Perhaps the most notable difference in how temperature changes may affect macroinvertebrates compared to fish is inherent to the differences in life cycles between the biota. Many macroinvertebrate life cycles involve multiple instars or developmental stages that can span several years before adulthood is reached. Elevated water temperatures can significantly accelerate progression through the various instar life stages, thereby potentially altering population dynamics and emergence time for some species. For example, Manuilova (1954, as cited by Alabaster and Lloyd 1980) found that a rise of about 27°F (15°C) reduced the embryonic development time of *Daphnia cucullata* from about 3 1/2 days to one day.

Like fish and macroinvertebrates, individual species of aquatic macrophytes and algae have specific temperature ranges within which they can exist. For example, the minimal temperature at which photosynthesis will occur for diatoms is about 41°F (5°C) for some species, 59°F (15°C) for others, with even higher minimum temperatures needed for many green and blue-green algae (Wetzel 1983). In general, the upper temperature limit acceptable to many species of aquatic macrophytes and algae (within a given aquatic system) is greater than that acceptable to most, and possibly all, of the fish and macroinvertebrates that reside in that same system. For example, many species of green and blue-green algae and many macrophytes thrive in waters having daily high temperatures in excess of 95°F (35°C). Moreover, some species of algal exhibit optimum growth at temperatures above 113°F (45°C) (Wetzel 1983).

Hence, with regard to an elevation in water temperatures in water bodies such as Deer Creek, particularly during the summer period of the year, it would be expected that adverse effects would begin to occur in the fish and macroinvertebrate communities before the plant communities would be adversely impacted. Exceptions to this generalization can exist. For example, certain species of algae undergo population “blooms” at specific temperatures. Hence, alteration of spring and fall temperatures could prevent blooms for certain algal species, and encourage them for others. Nevertheless, with regard to overall preservation of community composition, structure, and function, the plant communities within aquatic systems are generally less affected by alterations of “normal” seasonal temperature regimes than are the fish and macroinvertebrate communities in the same system. This, coupled with the societal value placed on animals versus plants, is why the scientific literature on this topic is dominated by studies pertaining to temperature effects on fish and macroinvertebrates rather than aquatic plants.

INFLUENCE OF TEMPERATURE ON HABITAT SELECTION BY FISH

Organisms respond to extreme high and low temperatures in a manner similar to the dosage-response pattern that is common to toxicant effects. Each fish species has a maximum upper thermal limit (often defined as the “incipient lethal temperature”) that it can tolerate for short periods of time (which varies somewhat based on several of the factors stated above), as well as an optimum temperature range for growth and overall health. Incipient lethal levels of temperature are those levels that will eventually cause the death of a stated fraction of the test organism, usually 50 percent (Warren 1971). Fish tend to occupy habitats having temperatures within the species’ thermal tolerance range that are somewhat below its upper incipient lethal temperature limit (e.g., Baltz et al. 1987; Cech et al. 1990). This is due to poor physiological performance and resultant changes in interspecies competition, disease, predation and other key ecological factors that occur at near-lethal temperatures (Fry 1967; USEPA 1973; Alabaster and Lloyd 1980). The maximum temperature at which a number of fish species have been consistently found in nature lies between the average of the optimum temperature and the temperature of zero growth (USEPA 1973). The optimum temperature may be influenced by rate of feeding. For example, Brett et al. (1969) demonstrated a shift in optimum temperature to colder temperatures for sockeye salmon when ration was restricted.

Optimum temperatures (e.g., those producing the most rapid growth rates) are not necessary at all times to maintain thriving populations and, in fact, are commonly exceeded in nature during summer months (USEPA 1973). Moreover, when provided with a choice in temperature gradient experiments, fish do not always select temperatures that maximize growth (USEPA 1973). In nature, the realized temperature limits for long-term exposures generally lie somewhere between the physiological optimum and upper incipient lethal temperature (USEPA 1973), and can be influenced by a number of other factors, including competition, physical habitat characteristics, food availability, and predation pressures.

EFFECTS OF RAPID TEMPERATURE CHANGE ON AQUATIC LIFE

The prevalent notion that large and sudden temperature changes are often fatal to fish because of the initial thermal shock involved is not supported by research conducted by Doudoroff (1957). This researcher found that acclimation by fish to heat occurs quite rapidly. Although there may be a latent period of about one day or longer, results from a number of studies have shown that the majority of the increase in heat resistance was achieved within one to three days. When fish acclimated to high temperatures are transferred back to lower temperatures, little to no resistance may be detectable after the first three days. Thus, a relatively brief exposure to non-lethal high temperatures, or intermittent exposure, can result in markedly increased resistance to heat, which is not readily lost upon subsequent exposure to lower temperatures.

Nevertheless, sudden changes in temperature can be harmful to fish and macroinvertebrates, depending on: 1) species and life stage; 2) prior acclimation temperature; 3) general condition of the organism; 4) other water quality parameters (e.g., dissolved oxygen); and 5) magnitude and direction of temperature change (McKee and Wolf 1963; USEPA 1973; Alabaster and Lloyd 1980; Cech et al. 1990). McKee and Wolf (1963) cited a study that determined rainbow trout could not tolerate a temperature shock of 20°F (11°C) above an acclimation temperature of 54°F (12°C), but could tolerate a 14°F (8°C) increase above an acclimation temperature of 50°F (10°C). U.S. EPA (1973) stated that moderate temperature fluctuations can generally be tolerated as long as a maximum upper limit is not exceeded for long periods. This is supported by more recent work conducted by Cech et al. (1990), where several species of native California fishes were acclimated to certain temperatures [i.e., 50, 59, 68, 77, 86°F (10, 15, 20, 25, and 30°C)] and then exposed to a 9°F (5°C) temperature increase over a 3-5 hour period. Findings from this study showed that fish metabolic rates were generally, but not always, elevated following such rapid changes in temperature, *but that mortality did not occur unless the elevated temperature to which fish were rapidly exposed was at or higher than their upper incipient lethal temperature*. In this study, California roach showed no significant increase in metabolic rate following an abrupt temperature increase from an acclimated temperature of 86 to 95°F (30°C to 35°C). In addition, this species showed no metabolic depression when exposed to hypoxic conditions at any temperature, and survived hypoxia at 95°F (35°C). The California roach is a native fish species found in Deer Creek.

These studies suggest that fish can withstand rapid changes in water temperature of (9-14.5°F) (5-8°C) without experiencing mortality and, in some cases, with little to no measurable physiological effects. The closer the acclimation temperature is to the species' upper or lower thermal tolerance limit, the smaller the species' tolerance of change in the direction of the limit. Conversely, as demonstrated by California roach, Sacramento pikeminnow, rainbow trout, and riffle sculpin, a rapid temperature change of 9°F (5°C) may result in little to no physiological impact when the initial and ending temperatures are within or near the preferred temperature range and do not encroach upon an incipient lethal temperature (Cech et al. 1990).

The CDFG hatchery operations and field stocking programs also provide evidence that fish such as rainbow trout can rapidly adjust to temperature differences of 9°F (5°C) and more. Rapid changes of 9°F (5°C) associated with moving rainbow trout from one facility to another or involving movement from the hatchery to a water body for stocking would not be expected to result in temperature-related fish losses. It is common for rainbow trout acclimated to hatchery water temperatures of approximately 60°F (15.5°C) to be loaded into a transport truck having water that is then rapidly cooled to approximately 48°F (9°C), where fish are held for several hours to 24 hours, and then delivered into a lake or other water body having a temperature near 59°F (15°C) – a rapid change of 11°F (T. West, Fish Hatchery Manager II, CDFG, pers. comm., 1998).

Less data are available regarding the effects of cold shock on fish. Based on personal experience in transporting and stocking rainbow trout, CDFG hatchery managers have noted that this species is less able to tolerate rapid movement into substantially colder water as opposed to movement into substantially warmer water (T. West, Fish Hatchery Manager II, CDFG, pers. comm., 1998). In one study reported by the U.S. EPA (USEPA 1973), channel catfish fingerlings were found to be more susceptible to predation following a cold shock of 41-43°F (22.9-24°C).

Based on the information presented above, rapid temperature increases of 9°F (5°C) and greater would generally be expected to result in no significant adverse impacts to fish, unless the ultimate temperature reached is at or near the species' upper incipient lethal limit.

Little information is available regarding the ability of specific macroinvertebrates to handle rapid changes in temperature. Hence, unless specific studies addressing specific macroinvertebrate species can be identified, the effects of temperature changes to macroinvertebrates will need to be inferred based on data available for fish.

In general, aquatic plants and algae typically tolerate greater and more rapid temperature changes than do fish and macroinvertebrates. Hence, temperature regimes protective of fish and macroinvertebrates would be protective of aquatic plant communities as well.

AQUATIC BIOTA OF DEER CREEK AND THEIR THERMAL TOLERANCES

Five fish surveys and two BMI surveys of Deer Creek, conducted between 1993 and 2000, were used to characterize the creek's aquatic ecology. Characterizations of both the fish and BMI communities that exist in the creek, above and below the DCWWTP, are provided in Section 3.2.1.1 of this Staff Report. The thermal tolerance information obtained from the scientific literature for the fish and BMI species observed in the creek are summarized below.

Fish Community

Moyle and Nichols (1973) and Moyle (1976) initially characterized native central California stream fish assemblages into the following three categories based on "zones" of elevation and stream habitat characteristics.

"rainbow trout zone" - Cold (typically less than 21°C (70°F)), clear, permanent creeks and streams of the higher elevations. Fish assemblage is dominated by rainbow trout, with sculpin (*Cottus* spp.) and speckled dace (*Rhinichthys osculus*) in the lower reaches.

"California roach zone" - Small, warm (up to 30°C (86°F)), ephemeral tributaries of larger streams. Fish assemblage is dominated by California roach, with young-of-the-year Sacramento pikeminnow and Sacramento sucker sometimes present.

"squawfish-sucker-hardhead zone" - Larger, low-elevation creeks and streams. Fish assemblage is dominated by Sacramento pikeminnow (formerly referred to as "squawfish"), Sacramento sucker, and hardhead, with tule perch (*Hysterocarpus traski*), sculpin, dace, and California roach sometimes present.

Because the common name of the Sacramento squawfish has been changed to Sacramento pikeminnow, "pikeminnow" is used throughout the remainder of the document to refer to this species. Also, hence forth the "squawfish-sucker-hardhead zone" will be referred to as the "pikeminnow-sucker-hardhead zone."

Deer Creek upstream of the DCWWTP is a low discharge, warm (commonly exceeding 70°F (21°C) in the summer (see Figure 9 and Figure 10 in Section 4.7.2.3.1) creek, dependent upon unregulated, underflow seepage from the Cameron Park Lake Dam as its source water during the non-precipitation period of the year. Based on past fish surveys conducted in Deer Creek (see Section 3.2.1.1.1), the fish community in Deer Creek upstream of the DCWWTP is dominated by bluegill and California roach, with green sunfish and mosquitofish also present. Based on available fish data, Deer Creek upstream of the DCWWTP is a classic example of a "California roach zone" creek (Moyle and Nichols 1973; Moyle 1976; Cech et al. 1990) that also has thriving populations of introduced fish species (i.e., bluegill, green sunfish, and mosquitofish).

Deer Creek's conditions downstream of the DCWWTP are characterized by somewhat higher water temperatures and flows compared to areas upstream of the DCWWTP. The higher flow rate is primarily the result of effluent discharges from the DCWWTP. The fish community in Deer Creek downstream of the DCWWTP (see Section 3.2.1.1.1) is dominated by bluegill, Sacramento pikeminnow, hardhead, Sacramento sucker, and green sunfish. Mosquitofish, prickly sculpin, and California roach also are present. Based on available fish data, Deer Creek downstream of the DCWWTP is a classic example of a "pikeminnow-sucker-hardhead" creek (Moyle and Nichols 1973; Moyle 1976; Cech et al. 1990) that also has thriving populations of introduced fish species (i.e., bluegill, green sunfish, and mosquitofish) and small populations of prickly sculpin

and California roach. The upper thermal limits and preferred temperatures of the dominant fish species identified in Deer Creek are provided in **Table D-1**.

Cech et al. (1990) ranked the upper temperature limits for the native California fish species they studied, in order of increasing tolerance, as rainbow trout < hardhead and Sacramento sucker < tule perch and riffle sculpin < Sacramento pikeminnow < California roach. These authors concluded that Sacramento pikeminnow appear to be more tolerant of high water temperatures (i.e., >86°F (30°C) but <95°F (35°C)) than Sacramento sucker and hardhead, suggesting that pikeminnow could occupy warmer waters than sucker or hardhead. Although hardhead may be limited to cooler areas of the pikeminnow-sucker-hardhead zones, pikeminnow and suckers have similar distributions in warmer areas (Moyle 1976). Brown et al. (1995) suggested the upstream limits for prickly sculpin may be associated with water temperatures in the range of 80-82°F (26.5-28°C). These researchers further stated that, although temperature tolerance data are not available for prickly sculpin, temperature tolerance data for other sculpin species suggest that such temperatures would be stressful or potentially lethal to prickly sculpin. However, prickly sculpins in Clear Lake, California regularly experience water temperatures in excess of 82°F (28°C), indicating that some populations of this species can acclimate to and survive high water temperatures (Brown et al. 1995).

Microhabitat studies in California foothill streams show that rainbow trout avoid temperatures above 68°F (20°C) (Baltz et al. 1987). Rainbow trout are not found in most low-elevation streams because temperatures are too high (i.e., >77°F (25°C)) throughout much of the year (Cech et al. 1990). Although low numbers of rainbow trout may enter low-elevation streams having temperatures that commonly exceed 77°F (25°C) as a result of dispersal from other source waters, self-sustaining populations cannot become established in such water bodies. Survival of these transient individuals for more than one season is questionable, particularly if temperatures in the stream exceed about 79°F (26°C) for even short periods of time (USEPA 1973; Alabaster and Lloyd 1980). The effect of temperature above 77°F (25°C) on rainbow trout metabolism prevents them from establishing viable populations in the pikeminnow-sucker-hardhead and California roach zones of foothill creeks (Cech et al. 1990).

Information regarding the spawning season and water temperatures at which spawning occurs for all fish species documented to have occurred in Deer Creek is provided in **Table D-2**.

Table D-1. **Upper temperature limits and preferred temperature ranges for fish species found in Deer Creek, or their close relatives.**

Multiple values represent limits reported from different studies. The references provided represents the source of this information, and not necessarily the original study that generated the reported temperature limits.

Fish Species	Upper Temperature Limit	Preferred Temperatures	References
California roach (<i>Hesperoleucus symmetricus</i>)	97-100°F (36-38°C)	75-84°F (24-29°C) ^a 84-95°F (29-35°C) ^h	Cech et al. 1985 Cech et al. 1990 Cech et al. 1990
Sacramento pikeminnow (<i>Ptychocheilus grandis</i>)	8 of 10 died when temp. inc. from 86°F (30°C) to 95°F (35°C), acclimated to 86°F (30°C) with no mortality 85°F (29.3°C) ^f (50% mortality in 24-h)	64-72°F (18-22°C) ^a 72.5-77°F (22.5-25°C) ^h	Cech et al. 1990 Cech et al. 1990
Sacramento sucker (<i>Castostomus occidentalis</i>)	79-86°F (26-30°C) Mortality occurred when acclimated to 86°F (30°C)	64-75°F (18-24°C) ^a 79-82°F (26-28°C) ^h	Est. based on Cech et al. 1990 Cech et al. 1990
	85-88°F (29.3-31.2°C) ^e 85.3°F (29.6°C), 84.7°F (29.3°C) ^g		Cech et al. 1990 Cech et al. 1990 McKee and Wolf 1963 USEPA 1973
Hard head (<i>Mylopharodon conocephalus</i>)	79-86°F (26-30°C)	64-75°F (18-24°C) ^a 68.9-82°F (20.5-28°C) ^h	Estimated based on Cech et al. 1990 Cech et al. 1990 Cech et al. 1990
Bluegill (<i>Lepomis macrochirus</i>)	106°F (41°C) 92.8-95°F (33.8-35°C) 86.9-92.8°F (30.5-33.8°C) (UUILT)	81°F (27°C) 83.3°F (28.5°C) (zero net growth)	Becker 1983 McKee and Wolf 1963 USEPA 1973, Table III-11 USEPA 1973, App. II-C
Green sunfish (<i>Lepomis cyanellus</i>)	91-93°F (33-34°C), 97°F (36°C)	82.8°F (28.2°C); 80.2°F (26.8°C)	Becker 1983
Prickly sculpin (<i>Cottus asper</i>)	79.7-82°F (26.5-28°C) 75.4°F (24.1°C) (50% mortality in 24-h)	64-72°F (18-22°C) ^a 72-84°F (28-29°C) ^h (riffle sculpin)	Brown et al. 1995 Black 1953 Cech et al. 1990
Mosquitofish (<i>Gambusia affinis</i>)	>86°F (30°C) 99.1°F (37.3°C) (UUILT) 98.6°F (37.0°C) (UUILT)	77-82°F (25-28°C) ^a	Cech et al. 1985 McKee and Wolf 1963 USEPA 1973, App. II-C
Rainbow trout (<i>Oncorhynchus mykiss</i>)	79.7°F (26.5°C) (UUILT) 76.8-79.3°F (24.9-26.3°C) 78.8°F (26.0°C)	59-68°F (15-20°C) 68-77°F (20-25°C) ^h 63-65.5°F (17-18.6°C) ^b , 66-72°F (19-22°C) ^c 50-55°F (10-13°C) ^d 55°F (13°C) 56.5°F (13.6°C) 68-70°F (20-21°C) (upper permissible temp. for sustaining population)	USEPA 1973, App. II-C Alabaster and Lloyd 1980 Kaya 1978, as cited by Behnke 1992 Baltz et al. 1987 Cech et al. 1990 Evans 1990 Sanders 1996 McKee and Wolf 1963 Alabaster and Lloyd 1980 Alabaster and Lloyd 1980

^a Estimated based on limited available information (i.e., professional opinion).

^b Produces maximum growth rates (Evans 1990).

^c Upper avoidance temperatures (Evans 1990).

^d Physiologically optimal temperatures for the overall health of rainbow trout (Sanders 1996).

^e Upper incipient lethal limit for common white sucker (*Catostomus commersoni*) as reported in McKee and Wolf (1963).

^f Value presented for Squaw fish (*Ptychocheilus oregonensis*) as reported in Black (1953).

^g Zero net growth for common white sucker (*Catostomus commersoni*) as reported in Table III-11 and lethal threshold as reported in Appendix II-C, respectively, of USEPA (1973).

^h Temperature maxima reported for adult, wild fish (Cech et al 1990).

UUILT = Ultimate upper incipient lethal temperature.

Table D-2. Reported spawning season and temperatures for the fish species documented to have occurred in Deer Creek.

Species	Spawning Season	Spawning Temperature	Reference
California roach	Mar-Jun	not reported	Moyle 1976
Sacramento pikeminnow	Apr-May	>57°F (14°C)	Moyle 1976
Sacramento sucker	Feb-Jun	> 42-51°F (5.6-10.6°C)	Moyle 1976
Hardhead	Apr-May	not reported	Moyle 1976
Bluegill	Apr-Aug	66-81°F (19-27°C)	Becker 1983
Green sunfish	Apr-Aug	59-82°F (15-28°C)	Becker 1983
Prickly sculpin	Mar-Apr	46-55°F (8-13°C)	Moyle 1976
Mosquitofish	Apr-Sep	not reported	Moyle 1976
Rainbow trout	Feb-Jun	41-59°F (5-15°C)	Moyle 1976 Becker 1982

Although Moyle (1976) did not report spawning temperatures for California roach, it is believed, based on spawning season, that spawning occurs over a broad range of temperatures. Based on a spawning season of March through June, it is estimated that successful roach spawning could occur at water temperatures ranging from approximately 54-70°F (12-21°C), and possibly higher. Moyle (1976) stated that spawning would be initiated by Sacramento pikeminnow at temperatures greater than 57°F (14°C) and by Sacramento sucker when temperatures reached the range of 42-51°F (5.6-10.6°C). It is uncertain what the upper temperature limit for successful spawning is for these species. Although Moyle (1976) provided no information on spawning temperatures for hardhead, they are likely to be similar to that for Sacramento pikeminnow because their respective spawning seasons are the same. Deer Creek's introduced centrarchids (i.e., bluegill and green sunfish) can successfully spawn at very high temperatures, relative to the creek's native species. This, coupled with the fact that these species have a protracted spawning season, suggest that they likely continue to spawn successfully in Deer Creek well into the summer period. This also is the case for mosquitofish.

Benthic Macroinvertebrate Community

Macroinvertebrates exhibit a pattern of temperature effects on growth that is very similar to that of fish (USEPA 1973). However, because many macroinvertebrate species' life cycles involve numerous instars or developmental stages, temperatures can play a significant role in defining population dynamics and timing of emergence of adult forms.

Little information is available in the scientific literature regarding the temperature tolerances of the dominant benthic macroinvertebrate species known to occur in Deer Creek, upstream of the DCWWTP. However, general classification of many of the dominant upstream taxa as being thermally tolerant or intolerant is possible (**Table D-3**). All of the Coleoptera (two riffle beetles, *Zaitzevia parvula* and *Microcylloepus similis* and the water penny beetle *Eubrianax edwardsii*) are known to be tolerant of a wide range of temperatures (W.D. Shepard, pers. comm., by W. Fields, 1996). The Trichoptera genus *Chimarra* is typically found in warm, slow moving water (Harris and Lawrence 1978). The caddisfly *Hydropsyche californica* and the mayfly *Baetis*

Table D-3. Thermal tolerance information for dominant taxa of benthic macroinvertebrates found in Deer Creek upstream of the DCWWTP's point of effluent discharge.

TAXONOMIC ORDER	TAXON	TEMPERATURE ADAPTATION
Trichoptera:	<i>Chimarra utahensis</i>	tolerant ^a
	<i>Hydropsyche californica</i>	tolerant
	<i>Lepidostoma sp.</i>	unknown
	<i>Micrasema sp.</i>	unknown
Coleoptera	<i>Microcylloepus similis</i>	tolerant
	<i>Zaitzevia parvula</i>	tolerant
	<i>Eubrianax edwardsii</i>	tolerant
Ephemeroptera	<i>Baetis tricaudatus</i>	tolerant
Odonata	<i>Argia sp. A</i>	tolerant
Diptera, Chironomidae	<i>Cricotopus sp. (treumuls group)</i>	unknown
Tplatyhelminthes	<i>Dugesia tigrina</i>	tolerant
Nemertea	<i>Prostoma graecense</i>	tolerant
Nematoda	<i>Tripyla sp.</i>	unknown
Gastropoda	<i>Fontelicella stearnsiana</i>	tolerant

^a Tolerant of warm water conditions.

tricaudatus are found in a wide variety of habitats and temperatures and, therefore, would be considered tolerant of warmwater conditions (W. Fields, pers. comm., 1996). In addition, the damselfly nymph *Argia sp.* is typically found in slow moving streams of the lower foothills and Sacramento Valley.

The flatworm *Dugesia tigrina* and the nemertine *Prostoma graecense* are, respectively, the most widely distributed species of their types in North America and are tolerant of warmwater conditions. The snail *Fontelicella stearnsiana* is known to occur throughout the central California coast ranges and into the Sierra Nevada foothills (Taylor 1980). It has also been collected in the Sacramento-San Joaquin Delta. Since most of the waters this snail inhabits are warm for prolonged periods of the year, it also is considered a thermally tolerant species. Nothing is known about the habitat preferences of the remaining dominant species.

Finally, the classically cold-water-adapted insect order Plecoptera was conspicuous in its complete absence at *upstream sites* in CDFG's 1994 BMI survey (CDFG 1995) and Bioassessment Services' 2000 BMI survey (BAS 2001). The CDFG spring 1998 survey found three individual Plecopterans in the collective upstream samples (all found at site U1, with none found at U2), one in the effluent channel, and none at downstream sites. The near-absence of stonefly species, in addition to the thermal tolerance information available on the dominant BMI species collected (Table D-3), suggests that Deer Creek upstream and downstream of the DCWWTP supports a macroinvertebrate assemblage that is characteristic of warmwater aquatic habitat. The fact that Plecopterans were

present at only one of the two upstream sites surveyed in 1998 and were found in the effluent channel indicates that Deer Creek as a water body simply does not provide the conditions necessary to support significant populations of Plecoptera taxa. These findings further indicate that this situation is an inherent characteristic of Deer Creek itself, and is not caused by effluent discharges from the DCWWTP.

APPENDIX E

CALIFORNIA DEPARTMENT OF FISH AND GAME RECOMMENDATIONS

DEPARTMENT OF FISH AND GAME

SACRAMENTO VALLEY AND CENTRAL SIERRA
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CALIFORNIA 95670
Telephone (916) 358-2900



February 14, 2001

Mr. Gary M. Carlton
California Regional Water Quality Control Board
Central Valley Region
3443 Routier Road, Suite A
Sacramento, California 95827-3098

Dear Mr. Carlton:

The Department of Fish and Game (Department) has been involved in the Basin Plan Amendment process for the El Dorado Irrigation District's (EID) Deer Creek Wastewater Treatment Plant (WWTP) for the last two years as the State's Trustee agency for fish and wildlife resources. The Department has devoted significant staff time to review all of the data collected and studies performed by either EID and their consultants or independent third parties on the Deer Creek watershed and ecosystem. As a result of this involvement, Department staff are intimate with the biotic and abiotic factors that influence the species composition and distribution in Deer Creek and the Cosumnes River. Therefore, the Department recommends the following thresholds for temperature compliance at station R2 in Deer Creek for the Basin Plan Amendment process for the EID Deer Creek WWTP:

Temperature Thresholds Recommendations for Deer Creek

Date	Daily Maximum (°F) ^a	Monthly Average (°F) ^b
January and February	63	58
March	65	60
April	71	64
May	77	68
June	81	74
July through September	81	77
October	77	72
November	73	65
December	65	58

a: Instantaneous maximum not to be exceeded

b: Defined as calendar month average

Mr. Gary M. Carlton
February 14, 2001
Page Two

Review of ambient water temperature data at station R1, located upstream of the Deer Creek WWTP, indicates daily maximum temperatures during the late spring, summer, and fall routinely exceed 70 degrees Fahrenheit (°F) and have spiked as high as 83°F. The thermal tolerances for rainbow trout are generally around 60 to 65°F (77°F is considered the upper limit for rainbow trout, Cech et.al. 1990). It is highly likely that Deer Creek did not have a self-sustaining rainbow trout population prior to urban development of the watershed. Deer Creek without the urban influences was likely to have been an ephemeral drainage with a species composition identified as the roach zone and the Sacramento pikeminnow-sucker-hardhead zone (Moyle 1976). Even with the urbanization and development in the Deer Creek watershed, the roach zone is maintained upstream of the barrier located at station R2 and the Sacramento pikeminnow-sucker-hardhead zone is maintained downstream of the barrier. The major differences are the increased summer base flow due to urbanization and the introduction of exotic sunfishes (Centrarchids) to the watershed.

There have been six fisheries assessments performed in the Deer Creek watershed since 1993. Only one survey has found rainbow trout (*Oncorhynchus mykiss*) in Deer Creek (CDFG 1994). Surveys performed by the Department, Surface Water Resources Inc., and the Nature Conservancy/UC Davis have subsequently not found any rainbow trout in the drainage. Based upon this extensive body of data, it is the Department's opinion that there are no resident populations of rainbow trout in Deer Creek. However, this does not preclude the use of Deer Creek, a tributary to the Cosumnes River by anadromous salmonids on an opportunistic basis. Historic and current information indicates that there is no self-sustaining annual run of steelhead trout (*Oncorhynchus mykiss*) in the Cosumnes River or its tributaries. Any utilization of the Cosumnes River by steelhead trout is on an opportunistic basis. Opportunistic use is defined by occasional pairs of fish entering the system and spawning successfully. The offspring would then need to exit the system prior to water temperatures exceeding a daily average of 65°F, and the cessation of contiguous flows in the lower reaches of Deer Creek.

The timing of any opportunistic use by steelhead trout would be from January through April (spawning would only occur in April if there was above normal precipitation between March and April and water temperatures were less than 58°F) when high-flow conditions would occur in this watershed. At this time of the year, water temperatures are not an issue because the ambient stream temperatures and discharges from the WWTP have a daily average less than 65°F (daily maximums range between 61 to 66°F).

The other anadromous salmonid that is present in the Cosumnes River watershed is fall-run chinook salmon (*Oncorhynchus tshawytscha*). Fall-run chinook salmon have never been documented in Deer Creek, however that does not preclude opportunistic use. The spawning run of fall-run chinook in the Cosumnes River is from late November through mid-February. The only time a run would occur in November or February would be when precipitation events

Mr. Gary M. Carlton
February 14, 2001
Page Three

generate enough flow for the Cosumnes to be contiguous through its entire length to the confluence with the Mokelumne River. Currently, fall-run chinook salmon cannot use the Cosumnes River in October and early November due to significant barriers and lack of suitable flows over those barriers. If hydrologic conditions improve with regulations and water rights, thus enabling fall-run chinook to utilize the lower Cosumnes River and Deer Creek during October and early November, the temperature recommendations and WWTP discharge alternatives should be reexamined to ensure that they are protective.

Deer Creek has a native species composition that is worthy of protection even though there are some exotic aquatic species present. The most recent fishery surveys conducted by SWRI and the Nature Conservancy/UC Davis indicate that the native populations are in good condition with all life stages present. A review of a recent U.S. Geological Survey study and other literature indicates that the fish assemblages present in Deer Creek are consistent with other Sierra Nevada foothill streams (Moyle and Nichols 1973; May and Brown 2000). Additionally, in 1998 the Department conducted a California Rapid Bioassessment Protocol (CRBP) that showed a healthy macroinvertebrate community that indicated a well functioning ecosystem. The results and conclusions of this 1998 bioassessment were in complete contrast with those reached in a 1994 CRBP performed by the Department (CDFG 1998). The 1994 CRBP study indicated a dysfunctional ecosystem, adversely impacted by discharges from the Deer Creek WWTP (Harrington and Schroeter 1994). The differences between the two studies are a direct result of significant improvements to the Deer Creek WWTP that began in 1996.

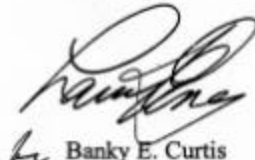
The temperature tolerances of the fish species that have been found in all of the surveys conducted from 1993 through 2000 are above those that have been recommended (Staff Report, Volume II, Table 2). Additionally, a U.S. Environmental Protection Agency (EPA) Gold Book analysis performed at the Boards' request indicated that acute and chronic criterion proposed for Deer Creek are lower than the calculated EPA acute and chronic criteria.

The abundance of studies and analysis that have been performed in the Deer Creek watershed are some of the most if not the most extensive to date for a Central Sierra Nevada foothill stream. The Department is confident the temperature recommendations are appropriate. However, if hydraulic conditions are improved enabling fall-run chinook to enter the Cosumnes River in October and early November then the temperature recommendations should be re-evaluated to ensure that they are protective during those months.

Mr. Gary M. Carlton
February 14, 2001
Page Four

If you have any questions about the recommendations that we have made or other issues pertaining to the Deer Creek WWTP Basin Plan Amendment, please contact Mr. Stafford Lehr, Associate Fishery Biologist, at (530) 626-3687, email at slehr@dfg.ca.gov, or Dr. Larry Eng, Assistant Regional Manager, at (916) 358-2919, email leng@dfg.ca.gov.

Sincerely,



Banky E. Curtis
Regional Manager

cc: Dr. Michael Bryan
Robertson-Bryan, Inc.
9766 Waterman Road, Suite L2
Elk Grove, California 95624

Mr. William Wilkins
General Manager
El Dorado Irrigation District
2890 Mosquito Road
Placerville, California 95667

Ms. Alice Q. Howard
El Dorado County Taxpayers For Quality Growth
1487 Crooked Mile Court
Placerville, California 95667

Mr. Larry Eng
Mr. Stafford Lehr
California Department of Fish and Game
1701 Nimbus Road, Suite A
Rancho Cordova, California 95670

Mr. Gary M. Carlton
February 14, 2001
Page Five

Literature Cited:

California Department of Fish and Game. 1994. Deer Creek Wastewater Treatment Plant effluent discharge investigation summary. Memorandum from Mr. Stafford Lehr to Mr. L. Ryan Broddrick, December 12, 1994.

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Moyle, P.B. 1976. *Inland Fishes of California*. University of California Press, Berkeley. 405 pp.

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APPENDIX F

LETTERS FROM THE INDIVIDUALS CITED AS PERSONAL COMMUNICATIONS IN THE DOCUMENT



ROBERTSON - BRYAN, INC.
Specializing in Water and Power Resources

9766 Waterman Road, Suite L2
Elk Grove, CA 95624
Telephone: (916) 714-1801
Fax: (916) 714-1804

Michael D. Bryan
Direct Line: (916) 714-1802

MEMORANDUM

EMAIL: bryan@robertson-
bryan.com

Date: January 7, 2003 **EID-101**
To: Mr. Robert Mahon
From: Michael D. Bryan, Ph.D.
Subject: Confirmation of personal communication regarding anadromous salmonid use
of Deer Creek and the creek's fall/early winter hydrology

I am working to assist the El Dorado Irrigation District and the Regional Water Quality Control Board in developing and adopting site-specific temperature objectives for Deer Creek. It was in this capacity that I discussed the above-referenced subjects with you on December 12, 2002. Following our discussion of these topics, I prepared several written statements, provided below, that were based on our conversation and which relate to your personal observations of Deer Creek over the years, in the reach of the creek that runs through your ranch. These statements have been prepared for inclusion in the Regional Water Quality Control Board, Central Valley Region Staff Report and Functional Equivalent Document, which proposes site-specific temperature objectives for Deer Creek to be included in the Regional Board Basin Plan.

I would appreciate your reviewing these statements and acknowledging that they are accurate and correct.

I. Proposed Revision #4 (Section 4.7.2.2) to the Draft Staff Report


"In addition to the 2002 field investigations that documented the above, an interview was conducted with a fourth-generation rancher, Mr. Robert Mahon, regarding his historic observations of Deer Creek flows in the fall/early winter. Mr. Mahon's ranch is located about one mile upstream of the confluence of Deer Creek with the Cosumnes River. He stated that there is almost never water flowing in Deer Creek, in the reach on his property, during October and November when the fall-run chinook salmon spawning run is occurring on the Cosumnes River. He stated that a lot of rain is required before this section of Deer Creek flows, which initially occurs in most years sometime in December. Mr. Mahon is 57 years old and has lived on this ranch his whole life (R. Mahon, pers. comm., December 12, 2002)."

II. Responses to Public Comments
Comment #A10

"Dr. Bryan, of Robertson-Bryan, Inc., technical consultant to EID who has played a major role in the preparation of the Draft Staff Report, interviewed Mr. Robert Mahon, a fourth generation rancher, who owns property that Deer Creek and the Cosumnes River traverse. His family has owned and worked the property for over 100 years. Deer

Creek passes through the property about one mile upstream from the Creek's confluence with the Cosumnes River. Dr. Bryan asked Mr. Mahon about his observations of anadromous fish in Deer Creek. Mr. Mahon stated that once, in the early 1960s, he observed juvenile salmon in the Creek. He stated that he did not recall adults in Deer Creek in the previous fall. He further stated that this spring sighting was the only time he had ever observed salmon in Deer Creek. Mr. Mahon is 57 years old and has lived his entire life on the ranch. He also reported that he did not recall his father ever telling him that his father had seen salmon in Deer Creek, but that both he and his father have observed salmon in the Cosumnes River annually. Mr. Mahon also stated in the interview that there is almost never water flowing in Deer Creek, in the reach on his property, during October and November when the fall-run chinook salmon spawning run is occurring on the Cosumnes River. He stated that a lot of rain is required before this section of Deer Creek flows, which occurs in most years sometime in December."

I have reviewed the above statements and find them to be accurate and correct.


Mr. Robert Mahon

1-7-03
Date

Michael Bryan

From: Wayne C. Fields, Jr. [wcf@cwia.com]
Sent: Sunday, May 26, 2002 5:40 PM
To: Dave@Robertson-Bryan.com
Subject: Deer Creek comments

Dave,

My comments about the relative thermal tolerances of the insects mentioned in your email of May 24 are, I believe, appropriate and factually correct.

Please contact me if you require any more information.

Wayne Fields

Michael Bryan

From: Kathy Hill [KHill@dfg.ca.gov]
Sent: Thursday, May 23, 2002 12:13 PM
To: dave@robertson-bryan.com
Subject: Re: Personal Communication Reference

Mr. Thomas: I have reviewed the Person Communication Citation document in which you present information attributed to me on anadromous fishes' use and potential use of the Cosumnes River watershed. These statements are correctly represented and I have no edits to the document.

Katherine Hill
Associate Wildlife Biologist
California Department of Fish and Game
Habitat Conservation Planning Branch
1416 Ninth Street, Room 1341
Sacramento, CA 95814
office (916) 651-8193
FAX (916) 653-2588
email: khill@dfg.ca.gov

>>> "Dave Thomas" <dave@robertson-bryan.com> 05/22/02 12:00PM >>>
Please see attachment.

Dave Thomas
Fisheries Biologist/Water Quality Specialist
Robertson-Bryan, Inc.
Voice (916) 714-1805
Fax (916) 714-1804
<<mailto:Dave@Robertson-Bryan.com>> <mailto:Dave@Robertson-Bryan.com>
<<http://www.Robertson-Bryan.com>> www.Robertson-Bryan.com



OWEN ENGINEERING & MANAGEMENT CONSULTANTS, INC.

3377 Coach Lane, Suite K
Cameron Park, California 95682
(530) 677-5286

May 31, 2002

Michael D. Bryan, Ph.D.
Partner/Senior Scientist
Robertson-Bryan, Inc.
9766 Waterman Road, Suite L2
El Grove, CA 95624

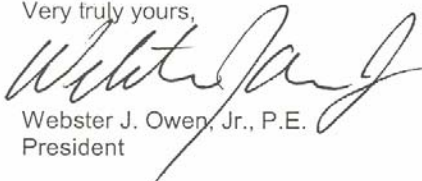
Re: Deer Creek Wastewater Treatment Plant
Personal Conversation

Dear Mike:

I have reviewed the paragraph that references our personal conversation of August 17, 2000 with respect to the Deer Creek Wastewater Treatment Plant expansion, and hereby verify that the paragraph is factually correct and represents the cost of improvement to the plant.

If you have any questions, please contact me directly.

Very truly yours,



Webster J. Owen, Jr., P.E.
President

Michael Bryan

From: Nimbus Fish Hatchery [NIMBFISH@dfg.ca.gov]
Sent: Wednesday, May 22, 2002 12:58 PM
To: dave@robertson-bryan.com
Subject: Re: Personal Communication Reference

Dave

I have received your e-mail and the information is correct, but let me add that if all possible temper water to match receiving water, it make's for good Fish Culture.

Terry

>>> "Dave Thomas" <dave@robertson-bryan.com> 05/22/02 12:06PM >>>
Please see attachment.

Dave Thomas
Fisheries Biologist/Water Quality Specialist
Robertson-Bryan, Inc.
Voice (916) 714-1805
Fax (916) 714-1804
<<mailto:Dave@Robertson-Bryan.com>> <mailto:Dave@Robertson-Bryan.com>
<<http://www.Robertson-Bryan.com>> www.Robertson-Bryan.com

Michael Bryan

From: Keith Whitener [kwhitener@cosumnes.org]
Sent: Tuesday, May 28, 2002 8:46 AM
To: 'Dave Thomas'
Subject: RE: Personal Communication Reference

Dave,

I have reviewed the statements attributed to me, and I find them to be appropriate and technically accurate. One additional data point is that the Fall 2000 chinook salmon run was estimated to be 580 using the Schafer statistical method. This differs slightly from the comment that the runs in the Cosumnes are "up to 500 fish". These comments were made previous to the 2000 year class.

Thanks, Keith

Keith Whitener
Cosumnes River Preserve
Project Ecologist
kwhitener@cosumnes.org
916 683-1767

-----Original Message-----

From: Dave Thomas [mailto:dave@robertson-bryan.com]
Sent: Wednesday, May 22, 2002 12:01 PM
To: Keith Whitener
Subject: Personal Communication Reference

Please see attachment.

Dave Thomas
Fisheries Biologist/Water Quality Specialist
Robertson-Bryan, Inc.
Voice (916) 714-1805
Fax (916) 714-1804
<mailto:Dave@Robertson-Bryan.com>
www.Robertson-Bryan.com

APPENDIX G

HISTORIC U.S. GEOLOGIC SURVEY FLOW DATA FOR DEER CREEK AT SLOUGHOUSE AND THE COSUMNES RIVER

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1960		
Day	Oct	Nov	Dec
1	0.0	0.0	53.0
2	0.0	0.0	81.0
3	0.0	0.0	19.0
4	0.0	0.0	7.7
5	0.0	0.0	4.7
6	0.0	0.0	3.8
7	0.0	0.0	3.1
8	0.0	0.0	2.5
9	0.0	0.0	2.0
10	0.0	0.0	1.9
11	0.0	0.0	2.8
12	0.0	0.0	2.8
13	0.0	0.0	2.7
14	0.0	0.0	2.3
15	0.0	0.0	2.1
16	0.0	0.0	2.4
17	0.0	0.0	3.1
18	0.0	0.0	3.0
19	0.0	0.0	2.3
20	0.0	0.0	2.3
21	0.0	0.0	1.9
22	0.0	0.0	1.9
23	0.0	0.0	2.0
24	0.0	0.0	2.0
25	0.0	0.0	1.7
26	0.0	7.4	1.7
27	0.0	3.6	1.9
28	0.0	1.0	1.7
29	0.0	0.5	1.6
30	0.0	0.3	1.4
31	0.0		1.2
Monthly Average:	0.0	0.4	7.2
Minimum Flow:	0.0	0.0	1.2
Peak Flow:	0.0	7.4	81.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1961											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.1	48.0	4.0	7.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.1	108.0	3.8	6.8	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1.1	68.0	3.8	5.8	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1.1	25.0	3.6	5.5	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1.1	14.0	3.5	5.2	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	1.1	11.0	3.6	4.6	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1.1	8.9	3.9	4.3	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1.1	7.2	3.7	3.9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	1.1	12.0	3.8	3.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	1.1	19.0	3.3	3.3	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	1.1	54.0	3.0	3.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	1.1	49.0	2.8	3.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	1.1	20.0	2.8	3.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	1.1	14.0	2.8	3.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	1.1	18.0	166.0	2.8	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	1.1	32.0	40.0	2.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	1.1	16.0	87.0	2.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	1.1	12.0	35.0	2.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	1.1	8.9	19.0	1.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	1.1	7.4	15.0	1.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	1.1	7.2	12.0	1.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	1.1	6.6	9.6	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	1.1	6.1	9.9	4.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	1.1	5.6	12.0	6.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	1.5	5.3	32.0	4.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	4.0	5.3	19.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	8.4	4.9	14.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	5.1	4.4	15.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	23.0		11.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	29.0		8.9	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	101.0		7.5		0.0		0.0	0.0		0.0		0.0
Monthly Average:	6.4	21.4	18.1	3.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Minimum Flow:	1.1	4.4	2.8	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peak Flow:	101.0	108.0	166.0	7.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1962											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	2.5	18.0	7.2	3.1	0.0	0.0	0.0	0.0	0.0	2.9	2.2
2	0.0	2.4	123.0	7.2	2.8	0.0	0.0	0.0	0.0	0.0	2.7	2.2
3	0.0	2.2	54.0	6.9	2.6	0.0	0.0	0.0	0.0	0.0	2.7	2.5
4	0.0	2.2	36.0	6.7	2.4	0.0	0.0	0.0	0.0	0.0	2.7	3.0
5	0.0	2.1	42.0	6.3	2.2	0.0	0.0	0.0	0.0	0.0	2.7	2.6
6	0.0	2.3	451.0	5.5	1.8	0.0	0.0	0.0	0.0	0.0	2.2	2.3
7	0.0	14.0	202.0	5.2	1.6	0.0	0.0	0.0	0.0	0.0	2.4	2.2
8	0.0	15.0	74.0	5.0	1.4	0.0	0.0	0.0	0.0	0.0	2.0	2.2
9	0.0	248.0	49.0	4.8	1.2	0.0	0.0	0.0	0.0	0.0	2.0	2.2
10	0.0	1,470.0	37.0	4.5	1.1	0.0	0.0	0.0	0.0	0.0	2.4	2.1
11	0.0	388.0	30.0	4.1	0.9	0.0	0.0	0.0	0.0	0.0	2.4	2.1
12	0.0	136.0	26.0	4.1	0.8	0.0	0.0	0.0	0.0	0.0	1.8	2.1
13	0.0	699.0	23.0	4.0	0.9	0.0	0.0	0.0	0.0	1,670.0	1.9	2.0
14	0.0	687.0	20.0	4.0	0.9	0.0	0.0	0.0	0.0	700.0	1.9	2.0
15	0.0	847.0	18.0	3.8	1.1	0.0	0.0	0.0	0.0	56.0	1.8	4.6
16	0.0	319.0	17.0	3.6	1.2	0.0	0.0	0.0	0.0	24.0	1.8	124.0
17	0.0	139.0	15.0	3.5	1.1	0.0	0.0	0.0	0.0	15.0	1.8	141.0
18	0.0	79.0	14.0	3.1	0.9	0.0	0.0	0.0	0.0	10.0	1.6	37.0
19	0.0	84.0	13.0	3.4	0.6	0.0	0.0	0.0	0.0	7.8	1.6	21.0
20	5.1	54.0	12.0	5.0	0.4	0.0	0.0	0.0	0.0	5.6	1.6	14.0
21	16.0	40.0	12.0	5.2	0.3	0.0	0.0	0.0	0.0	5.2	1.9	10.0
22	7.7	33.0	13.0	4.1	0.2	0.0	0.0	0.0	0.0	4.6	1.9	8.5
23	6.7	29.0	16.0	3.5	0.1	0.0	0.0	0.0	0.0	4.3	2.0	7.7
24	7.6	25.0	12.0	2.7	0.0	0.0	0.0	0.0	0.0	3.8	2.0	7.2
25	5.7	23.0	10.0	2.5	0.0	0.0	0.0	0.0	0.0	3.8	2.0	7.7
26	4.3	24.0	9.1	2.3	0.0	0.0	0.0	0.0	0.0	3.7	2.0	6.6
27	3.5	21.0	8.5	2.4	0.0	0.0	0.0	0.0	0.0	3.3	3.3	5.8
28	3.1	18.0	8.0	3.6	0.0	0.0	0.0	0.0	0.0	3.0	2.8	5.2
29	2.9		7.4	5.1	0.0	0.0	0.0	0.0	0.0	3.5	2.3	4.6
30	2.6		7.2	3.8	0.0	0.0	0.0	0.0	0.0	3.1	2.2	4.6
31	2.4		7.2		0.0		0.0	0.0		3.0		4.8
Monthly Average:	2.2	193.1	44.7	4.4	1.0	0.0	0.0	0.0	0.0	81.6	2.2	14.4
Minimum Flow:	0.0	2.1	7.2	2.3	0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.0
Peak Flow:	16.0	1,470.0	451.0	7.2	3.1	0.0	0.0	0.0	0.0	1,670.0	3.3	141.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1963											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	5.0	1,150.0	10.0	59.0	18.0	3.7	0.0	0.0	0.0	0.0	0.0	7.7
2	5.0	170.0	9.1	37.0	16.0	3.3	0.0	0.0	0.0	0.0	0.0	7.0
3	4.8	72.0	8.0	29.0	16.0	2.8	0.0	0.0	0.0	0.0	0.0	6.4
4	5.0	47.0	7.2	26.0	14.0	2.4	0.0	0.0	0.0	0.0	0.0	5.9
5	4.8	35.0	7.5	34.0	13.0	2.4	0.0	0.0	0.0	0.0	0.0	5.8
6	4.4	26.0	8.0	849.0	12.0	2.3	0.0	0.0	0.0	0.0	0.0	5.2
7	4.4	23.0	8.5	542.0	11.0	2.4	0.0	0.0	0.0	0.0	0.0	5.6
8	4.7	19.0	8.2	177.0	11.0	2.2	0.0	0.0	0.0	0.0	0.0	5.4
9	3.9	18.0	8.0	86.0	15.0	2.1	0.0	0.0	0.0	0.0	0.0	7.1
10	4.1	33.0	8.0	166.0	12.0	2.0	0.0	0.0	0.0	0.0	0.0	8.9
11	4.5	22.0	7.5	148.0	38.0	1.8	0.0	0.0	0.0	0.0	0.0	6.9
12	3.9	21.0	7.0	68.0	21.0	1.6	0.0	0.0	0.0	0.0	0.0	6.0
13	3.8	227.0	6.5	46.0	15.0	1.5	0.0	0.0	0.0	0.0	0.0	5.5
14	4.0	88.0	6.6	806.0	13.0	1.4	0.0	0.0	0.0	0.0	6.7	5.4
15	4.3	47.0	8.5	369.0	11.0	1.4	0.0	0.0	0.0	0.0	174.0	5.4
16	4.4	33.0	9.2	151.0	10.0	1.3	0.0	0.0	0.0	0.0	20.0	5.1
17	4.6	28.0	23.0	85.0	9.3	1.0	0.0	0.0	0.0	0.0	7.5	5.0
18	4.3	25.0	18.0	57.0	8.7	0.8	0.0	0.0	0.0	0.0	5.0	5.0
19	4.0	21.0	11.0	66.0	8.0	0.5	0.0	0.0	0.0	0.0	41.0	5.2
20	4.3	18.0	9.4	61.0	7.4	0.3	0.0	0.0	0.0	0.0	512.0	5.8
21	6.5	17.0	9.1	65.0	7.1	0.1	0.0	0.0	0.0	0.0	50.0	6.5
22	7.8	15.0	8.9	42.0	6.7	0.0	0.0	0.0	0.0	0.0	18.0	6.2
23	8.1	13.0	22.0	35.0	7.4	0.0	0.0	0.0	0.0	0.0	151.0	5.4
24	7.1	12.0	35.0	29.0	6.7	0.0	0.0	0.0	0.0	0.0	120.0	5.2
25	6.1	11.0	19.0	27.0	6.2	0.0	0.0	0.0	0.0	0.0	31.0	5.2
26	5.6	10.0	15.0	33.0	5.9	0.0	0.0	0.0	0.0	0.0	18.0	5.0
27	5.6	9.7	222.0	30.0	5.1	0.0	0.0	0.0	0.0	0.0	13.0	4.9
28	6.3	10.0	1,190.0	25.0	5.2	0.0	0.0	0.0	0.0	0.0	11.0	4.6
29	6.4		207.0	23.0	4.5	0.0	0.0	0.0	0.0	0.0	9.5	4.6
30	64.0		86.0	20.0	4.9	0.0	0.0	0.0	0.0	0.0	8.2	4.4
31	1,200.0		56.0		4.3		0.0	0.0		0.0		3.9
Monthly Average:	45.5	79.3	66.4	139.7	11.1	1.2	0.0	0.0	0.0	0.0	39.9	5.7
Minimum Flow:	3.8	9.7	6.5	20.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	3.9
Peak Flow:	1,200.0	1,150.0	1,190.0	849.0	38.0	3.7	0.0	0.0	0.0	0.0	512.0	8.9

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1964											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3.8	9.3	7.4	6.9	1.4	0.2	0.0	0.0	0.0	0.0	0.0	5.2
2	3.8	9.4	8.7	13.0	1.6	0.1	0.0	0.0	0.0	0.0	0.0	7.4
3	3.8	8.5	7.6	7.6	1.8	0.1	0.0	0.0	0.0	0.0	0.0	22.0
4	3.1	8.5	6.0	6.3	2.6	0.0	0.0	0.0	0.0	0.0	0.0	19.0
5	3.3	8.2	5.3	6.7	3.8	0.0	0.0	0.0	0.0	0.0	0.0	11.0
6	3.3	7.7	4.9	5.8	6.5	0.0	0.0	0.0	0.0	0.0	0.0	8.5
7	3.3	7.1	4.5	5.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	6.9
8	3.6	6.8	4.3	4.8	4.5	0.0	0.0	0.0	0.0	0.0	0.0	6.2
9	2.9	6.6	4.2	4.2	3.0	0.0	0.0	0.0	0.0	0.0	22.0	5.6
10	2.5	7.5	4.0	3.9	2.5	0.4	0.0	0.0	0.0	0.0	112.0	5.7
11	2.1	7.1	4.1	3.7	2.0	0.3	0.0	0.0	0.0	0.0	45.0	23.0
12	2.0	6.6	6.4	3.5	1.7	0.2	0.0	0.0	0.0	0.0	129.0	28.0
13	2.0	6.3	8.7	3.2	1.4	0.2	0.0	0.0	0.0	0.0	27.0	16.0
14	2.1	6.2	5.9	2.7	1.2	0.2	0.0	0.0	0.0	0.0	12.0	13.0
15	3.3	7.4	4.8	2.7	1.0	0.1	0.0	0.0	0.0	0.0	6.8	13.0
16	2.7	8.8	4.3	2.7	0.8	0.0	0.0	0.0	0.0	0.0	5.1	12.0
17	2.9	8.1	3.9	2.6	0.7	0.0	0.0	0.0	0.0	0.0	3.9	11.0
18	12.0	6.9	3.5	2.4	0.7	0.0	0.0	0.0	0.0	0.0	3.1	10.0
19	25.0	5.6	3.1	2.4	0.4	0.0	0.0	0.0	0.0	0.0	2.4	68.0
20	158.0	5.4	3.1	2.9	0.4	0.0	0.0	0.0	0.0	0.0	2.0	478.0
21	1,170.0	5.3	3.1	2.2	0.4	0.0	0.0	0.0	0.0	0.0	1.5	799.0
22	661.0	5.1	3.6	2.2	0.4	0.0	0.0	0.0	0.0	0.0	1.6	1,690.0
23	135.0	4.7	9.7	2.0	0.3	0.0	0.0	0.0	0.0	0.0	1.3	1,760.0
24	51.0	4.6	16.0	2.1	0.3	0.0	0.0	0.0	0.0	0.0	1.2	477.0
25	30.0	4.6	8.4	2.2	0.1	0.0	0.0	0.0	0.0	0.0	1.6	149.0
26	23.0	4.7	6.5	2.0	0.2	0.0	0.0	0.0	0.0	0.0	2.7	337.0
27	18.0	4.2	6.0	1.9	0.8	0.0	0.0	0.0	0.0	0.0	3.7	358.0
28	14.0	4.8	5.2	1.9	0.8	0.0	0.0	0.0	0.0	0.0	3.0	248.0
29	13.0	7.0	4.6	1.7	0.3	0.0	0.0	0.0	0.0	0.0	2.4	318.0
30	11.0		4.4	1.8	0.1	0.0	0.0	0.0	0.0	0.0	2.4	398.0
31	11.0		4.6		0.0		0.0	0.0		0.0		398.0
Monthly Average:	76.9	6.7	5.7	3.8	1.6	0.1	0.0	0.0	0.0	0.0	13.1	248.4
Minimum Flow:	2.0	4.2	3.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2
Peak Flow:	1,170.0	9.4	16.0	13.0	7.7	0.4	0.0	0.0	0.0	0.0	129.0	1,760.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1965											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	140.0	30.0	13.0	27.0	13.0	1.9	0.0	0.0	0.0	0.0	0.0	2.9
2	98.0	27.0	12.0	21.0	11.0	2.1	0.0	0.0	0.0	0.0	0.0	2.7
3	484.0	25.0	11.0	18.0	10.0	2.2	0.0	0.0	0.0	0.0	0.0	2.3
4	724.0	26.0	10.0	16.0	9.9	2.3	0.0	0.0	0.0	0.0	0.0	2.5
5	329.0	47.0	9.0	15.0	9.3	2.5	0.0	0.0	0.0	0.0	0.0	2.5
6	1,360.0	46.0	8.8	16.0	8.9	2.5	0.0	0.0	0.0	0.0	0.0	2.5
7	714.0	32.0	11.0	15.0	9.1	2.6	0.0	0.0	0.0	0.0	0.0	2.0
8	191.0	26.0	9.0	19.0	7.6	2.6	0.0	0.0	0.0	0.0	0.0	2.0
9	117.0	23.0	8.4	219.0	7.6	3.0	0.0	0.0	0.0	0.0	0.0	1.9
10	87.0	21.0	8.9	689.0	7.1	2.9	0.0	0.0	0.0	0.0	0.0	2.0
11	74.0	20.0	9.5	173.0	6.7	2.5	0.0	0.0	0.0	0.0	0.0	2.5
12	62.0	19.0	83.0	91.0	7.6	1.9	0.0	0.0	0.0	0.0	0.0	4.7
13	52.0	20.0	66.0	67.0	6.6	1.3	0.0	0.0	0.0	0.0	0.0	8.2
14	46.0	20.0	29.0	56.0	6.5	1.0	0.0	0.0	0.0	0.0	0.0	5.0
15	42.0	18.0	21.0	44.0	6.5	0.7	0.0	0.0	0.0	0.0	0.0	3.7
16	38.0	17.0	16.0	336.0	5.5	0.2	0.0	0.0	0.0	0.0	0.0	3.1
17	35.0	16.0	14.0	127.0	5.1	0.1	0.0	0.0	0.0	0.0	0.0	2.6
18	34.0	15.0	14.0	77.0	4.4	0.1	0.0	0.0	0.0	0.0	3.7	2.4
19	61.0	15.0	13.0	62.0	3.9	0.3	0.0	0.0	0.0	0.0	19.0	2.1
20	74.0	14.0	13.0	49.0	3.8	0.6	0.0	0.0	0.0	0.0	7.4	1.7
21	46.0	14.0	12.0	56.0	4.2	0.5	0.0	0.0	0.0	0.0	3.7	1.6
22	40.0	13.0	12.0	41.0	4.5	0.4	0.0	0.0	0.0	0.0	2.4	1.7
23	86.0	12.0	12.0	36.0	4.5	0.3	0.0	0.0	0.0	0.0	2.8	1.8
24	159.0	12.0	11.0	30.0	3.6	0.3	0.0	0.0	0.0	0.0	56.0	2.1
25	63.0	11.0	11.0	27.0	2.5	0.3	0.0	0.0	0.0	0.0	29.0	381.0
26	51.0	11.0	13.0	24.0	2.3	0.2	0.0	0.0	0.0	0.0	11.0	48.0
27	41.0	20.0	106.0	20.0	2.1	0.2	0.0	0.0	0.0	0.0	6.7	17.0
28	39.0	19.0	50.0	18.0	1.7	0.1	0.0	0.0	0.0	0.0	4.4	216.0
29	36.0		29.0	16.0	1.4	0.1	0.0	0.0	0.0	0.0	3.5	454.0
30	35.0		23.0	15.0	1.4	0.0	0.0	0.0	0.0	0.0	3.1	189.0
31	32.0		20.0		1.6		0.0	0.0		0.0		429.0
Monthly Average:	173.9	21.0	21.9	80.7	5.8	1.2	0.0	0.0	0.0	0.0	5.1	58.1
Minimum Flow:	32.0	11.0	8.4	15.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.6
Peak Flow:	1,360.0	47.0	106.0	689.0	13.0	3.0	0.0	0.0	0.0	0.0	56.0	454.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1966											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	86.0	92.0	18.0	4.9	1.1	0.0	0.0	0.0	0.0			
2	38.0	62.0	16.0	4.8	0.9	0.0	0.0	0.0	0.0			
3	26.0	39.0	14.0	4.4	0.7	0.0	0.0	0.0	0.0			
4	27.0	41.0	13.0	4.4	0.6	0.0	0.0	0.0	0.0			
5	268.0	78.0	13.0	4.4	0.5	0.0	0.0	0.0	0.0			
6	74.0	351.0	13.0	4.4	0.4	0.0	0.0	0.0	0.0			
7	41.0	97.0	13.0	4.4	0.3	0.0	0.0	0.0	0.0			
8	30.0	56.0	12.0	4.4	0.3	0.0	0.0	0.0	0.0			
9	24.0	39.0	11.0	4.4	0.2	0.0	0.0	0.0	0.0			
10	20.0	31.0	12.0	5.1	0.8	0.0	0.0	0.0	0.0			
11	18.0	25.0	13.0	6.4	1.0	0.0	0.0	0.0	0.0			
12	16.0	22.0	11.0	7.7	1.8	0.0	0.0	0.0	0.0			
13	14.0	19.0	11.0	8.3	1.2	0.0	0.0	0.0	0.0			
14	13.0	18.0	11.0	6.0	0.6	0.0	0.0	0.0	0.0			
15	12.0	16.0	10.0	4.7	0.5	0.0	0.0	0.0	0.0			
16	11.0	15.0	10.0	4.1	0.2	0.0	0.0	0.0	0.0			
17	10.0	14.0	9.6	4.3	0.1	0.0	0.0	0.0	0.0			
18	10.0	13.0	9.1	4.0	0.0	0.0	0.0	0.0	0.0			
19	10.0	13.0	8.7	4.0	0.0	0.0	0.0	0.0	0.0			
20	8.8	13.0	9.3	3.8	0.0	0.0	0.0	0.0	0.0			
21	8.2	12.0	8.6	3.6	0.0	0.0	0.0	0.0	0.0			
22	8.1	12.0	8.1	3.3	0.0	0.0	0.0	0.0	0.0			
23	8.1	13.0	7.9	3.2	0.0	0.0	0.0	0.0	0.0			
24	8.0	14.0	7.5	3.8	0.0	0.0	0.0	0.0	0.0			
25	7.5	17.0	7.4	3.7	0.0	0.0	0.0	0.0	0.0			
26	7.0	56.0	6.7	3.1	0.0	0.0	0.0	0.0	0.0			
27	6.9	28.0	6.4	2.8	0.0	0.0	0.0	0.0	0.0			
28	6.8	20.0	6.4	2.1	0.0	0.0	0.0	0.0	0.0			
29	18.0		6.2	1.7	0.0	0.0	0.0	0.0	0.0			
30	620.0		5.4	1.3	0.0	0.0	0.0	0.0	0.0			
31	159.0		5.3		0.0		0.0	0.0				
Monthly Average:	52.1	43.8	10.1	4.3	0.4	0.0	0.0	0.0	0.0			
Minimum Flow:	6.8	12.0	5.3	1.3	0.0	0.0	0.0	0.0	0.0			
Peak Flow:	620.0	351.0	18.0	8.3	1.8	0.0	0.0	0.0	0.0			

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1967		
Day	Oct	Nov	Dec
1	0.0	0.0	5.0
2	0.0	0.0	4.4
3	0.0	0.0	2.5
4	0.0	0.0	4.4
5	0.0	0.0	41.0
6	0.0	0.0	15.0
7	0.0	0.0	11.0
8	0.0	0.0	17.0
9	0.0	0.0	6.3
10	0.0	0.0	4.3
11	0.0	0.0	3.4
12	0.0	0.0	3.0
13	0.0	0.0	2.4
14	0.0	0.0	2.2
15	0.0	0.0	2.2
16	0.0	0.0	2.2
17	0.0	0.0	2.2
18	0.0	0.0	2.8
19	0.0	0.0	3.6
20	0.0	0.0	4.5
21	0.0	0.0	3.3
22	0.0	0.0	2.7
23	0.0	0.0	2.5
24	0.0	0.0	2.2
25	0.0	0.0	2.2
26	0.0	0.0	2.2
27	0.0	0.0	2.2
28	0.0	0.0	2.1
29	0.0	0.0	1.9
30	0.0	0.0	1.9
31	0.0		1.9
Monthly Average:	0.0	0.0	5.3
Minimum Flow:	0.0	0.0	1.9
Peak Flow:	0.0	0.0	41.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1968											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.9	46.0	10.0	11.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	2.7
2	1.9	28.0	9.9	15.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	3.2
3	1.9	23.0	8.6	12.0	2.2	0.0	0.0	0.0	0.0	0.0	3.4	3.0
4	1.7	18.0	7.8	9.9	2.0	0.0	0.0	0.0	0.0	0.0	24.0	2.8
5	1.6	15.0	7.9	9.2	2.2	0.0	0.0	0.0	0.0	0.0	7.5	2.8
6	1.6	12.0	7.4	8.7	2.5	0.0	0.0	0.0	0.0	0.0	3.5	2.8
7	1.6	11.0	7.8	7.9	2.3	0.0	0.0	0.0	0.0	0.0	2.2	2.8
8	1.7	9.9	123.0	7.3	1.9	0.0	0.0	0.0	0.0	0.0	1.6	3.2
9	1.9	9.0	40.0	7.0	1.4	0.0	0.0	0.0	0.0	0.0	1.2	3.2
10	15.0	8.8	21.0	6.7	1.1	0.0	0.0	0.0	0.0	0.0	1.0	4.2
11	34.0	8.3	16.0	6.6	1.0	0.0	0.0	0.0	0.0	0.0	1.0	48.0
12	12.0	7.6	14.0	5.6	1.2	0.0	0.0	0.0	0.0	0.0	1.5	22.0
13	7.4	7.4	29.0	5.4	2.0	0.0	0.0	0.0	0.0	0.0	4.8	12.0
14	6.2	6.9	39.0	5.2	5.0	0.0	0.0	0.0	0.0	0.0	4.1	93.0
15	125.0	5.7	31.0	4.9	7.0	0.0	0.0	0.0	0.0	0.0	5.1	105.0
16	56.0	5.5	213.0	4.9	4.0	0.0	0.0	0.0	0.0	0.0	11.0	84.0
17	22.0	82.0	139.0	4.9	2.7	0.0	0.0	0.0	0.0	0.0	5.1	31.0
18	13.0	52.0	53.0	4.5	2.1	0.0	0.0	0.0	0.0	0.0	4.2	21.0
19	9.7	92.0	34.0	4.5	1.8	0.0	0.0	0.0	0.0	0.0	5.1	17.0
20	8.1	654.0	25.0	4.3	1.4	0.0	0.0	0.0	0.0	0.0	6.1	18.0
21	7.2	321.0	21.0	4.4	1.0	0.0	0.0	0.0	0.0	0.0	3.9	15.0
22	6.3	85.0	18.0	4.2	1.1	0.0	0.0	0.0	0.0	0.0	3.0	13.0
23	5.7	68.0	16.0	4.0	1.1	0.0	0.0	0.0	0.0	0.0	2.6	12.0
24	5.2	45.0	15.0	4.0	0.9	0.0	0.0	0.0	0.0	0.0	2.6	37.0
25	4.9	28.0	13.0	3.8	1.3	0.0	0.0	0.0	0.0	0.0	2.5	226.0
26	4.9	20.0	13.0	3.6	1.4	0.0	0.0	0.0	0.0	0.0	3.0	107.0
27	4.5	16.0	11.0	3.4	1.4	0.0	0.0	0.0	0.0	0.0	2.6	46.0
28	4.4	14.0	10.0	3.2	1.0	0.0	0.0	0.0	0.0	0.0	2.2	44.0
29	4.1	12.0	9.7	2.9	0.4	0.0	0.0	0.0	0.0	0.0	2.2	40.0
30	340.0		9.4	2.7	0.1	0.0	0.0	0.0	0.0	0.0	2.6	29.0
31	246.0		9.3		0.0		0.0	0.0		0.0		25.0
Monthly Average:	30.9	59.0	31.7	6.1	1.9	0.0	0.0	0.0	0.0	0.0	4.0	34.7
Minimum Flow:	1.6	5.5	7.4	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7
Peak Flow:	340.0	654.0	213.0	15.0	7.0	0.0	0.0	0.0	0.0	0.0	24.0	226.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1969											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	23.0	76.0	573.0	23.0	13.0	1.5	0.0	0.0	0.0	0.0	0.0	1.2
2	22.0	68.0	190.0	23.0	13.0	1.2	0.0	0.0	0.0	0.0	0.0	1.2
3	22.0	60.0	167.0	34.0	12.0	1.1	0.0	0.0	0.0	0.0	0.0	1.4
4	21.0	57.0	113.0	25.0	13.0	1.3	0.0	0.0	0.0	0.0	0.0	1.3
5	20.0	145.0	89.0	322.0	13.0	1.3	0.0	0.0	0.0	0.0	0.0	1.1
6	19.0	737.0	77.0	176.0	11.0	1.2	0.0	0.0	0.0	0.0	0.0	0.9
7	19.0	185.0	67.0	78.0	9.9	1.2	0.0	0.0	0.0	0.0	4.1	1.0
8	18.0	114.0	60.0	57.0	9.9	1.4	0.0	0.0	0.0	0.0	2.5	1.5
9	15.0	107.0	73.0	47.0	9.2	1.5	0.0	0.0	0.0	0.0	2.2	1.6
10	15.0	89.0	117.0	41.0	8.7	2.2	0.0	0.0	0.0	0.0	1.6	1.9
11	83.0	230.0	65.0	36.0	8.1	2.9	0.0	0.0	0.0	0.0	1.4	2.6
12	112.0	251.0	63.0	33.0	7.6	3.4	0.0	0.0	0.0	0.0	1.2	3.7
13	1,460.0	45.0	67.0	30.0	7.6	3.2	0.0	0.0	0.0	0.0	1.0	4.0
14	597.0	51.0	54.0	29.0	7.3	2.6	0.0	0.0	0.0	0.0	1.0	2.8
15	115.0	187.0	49.0	27.0	7.3	2.1	0.0	0.0	0.0	0.0	1.0	2.6
16	70.0	71.0	46.0	25.0	7.3	1.9	0.0	0.0	0.0	0.0	1.0	2.1
17	51.0	31.0	47.0	23.0	6.7	1.6	0.0	0.0	0.0	0.0	1.4	1.8
18	204.0	149.0	44.0	22.0	6.2	1.2	0.0	0.0	0.0	0.0	1.2	1.6
19	1,360.0	182.0	40.0	21.0	6.2	1.1	0.0	0.0	0.0	0.0	1.0	3.6
20	2,160.0	144.0	39.0	20.0	5.7	1.1	0.0	0.0	0.0	0.0	1.2	78.0
21	875.0	113.0	69.0	19.0	5.2	0.9	0.0	0.0	0.0	0.0	1.1	343.0
22	595.0	91.0	44.0	19.0	6.2	0.6	0.0	0.0	0.0	0.0	1.1	79.0
23	138.0	530.0	38.0	34.0	5.4	0.5	0.0	0.0	0.0	0.0	1.0	69.0
24	240.0	501.0	34.0	33.0	5.5	0.4	0.0	0.0	0.0	0.0	1.0	628.0
25	902.0	671.0	32.0	22.0	6.0	0.2	0.0	0.0	0.0	0.0	1.0	140.0
26	793.0	469.0	31.0	20.0	5.3	0.0	0.0	0.0	0.0	0.0	0.9	61.0
27	174.0	167.0	29.0	18.0	4.9	0.0	0.0	0.0	0.0	0.0	0.9	34.0
28	199.0	357.0	29.0	16.0	4.7	0.0	0.0	0.0	0.0	0.0	1.0	24.0
29	123.0		27.0	15.0	4.3	0.0	0.0	0.0	0.0	0.0	1.0	19.0
30	106.0		25.0	14.0	3.1	0.0	0.0	0.0	0.0	0.0	1.0	15.0
31	88.0		24.0		2.1		0.0	0.0		0.0		12.0
Monthly Average:	343.2	209.9	78.1	43.4	7.6	1.3	0.0	0.0	0.0	0.0	1.1	49.7
Minimum Flow:	15.0	31.0	24.0	14.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Peak Flow:	2,160.0	737.0	573.0	322.0	13.0	3.4	0.0	0.0	0.0	0.0	4.1	628.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1970											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	11.0	42.0	104.0	9.5	3.3	0.0	0.0	0.0	0.0	0.0	0.0	462.0
2	9.5	37.0	79.0	8.9	3.1	0.0	0.0	0.0	0.0	0.0	0.0	773.0
3	8.7	33.0	45.0	8.8	2.9	0.0	0.0	0.0	0.0	0.0	0.0	205.0
4	8.4	31.0	138.0	8.5	2.7	0.0	0.0	0.0	0.0	0.0	0.9	1,200.0
5	8.0	28.0	109.0	8.0	2.5	0.0	0.0	0.0	0.0	0.0	1.3	275.0
6	7.4	25.0	57.0	7.7	2.6	0.0	0.0	0.0	0.0	0.0	2.0	107.0
7	6.9	24.0	46.0	7.3	2.8	0.0	0.0	0.0	0.0	0.0	2.3	58.0
8	7.0	23.0	149.0	6.7	2.8	0.0	0.0	0.0	0.0	0.0	2.6	57.0
9	16.0	22.0	72.0	6.5	3.0	0.0	0.0	0.0	0.0	0.0	2.6	56.0
10	145.0	21.0	114.0	6.5	3.2	0.0	0.0	0.0	0.0	0.0	2.6	39.0
11	50.0	21.0	64.0	6.5	3.0	0.0	0.0	0.0	0.0	0.0	2.6	34.0
12	45.0	23.0	51.0	6.1	2.7	0.0	0.0	0.0	0.0	0.0	2.6	31.0
13	72.0	48.0	44.0	6.7	2.5	0.0	0.0	0.0	0.0	0.0	2.6	29.0
14	1,200.0	72.0	39.0	13.0	2.3	0.0	0.0	0.0	0.0	0.0	2.6	25.0
15	185.0	38.0	35.0	13.0	1.7	0.0	0.0	0.0	0.0	0.0	2.6	22.0
16	1,030.0	41.0	32.0	9.2	1.5	0.0	0.0	0.0	0.0	0.0	2.6	171.0
17	989.0	269.0	29.0	7.7	1.3	0.0	0.0	0.0	0.0	0.0	2.6	163.0
18	170.0	123.0	25.0	6.6	0.9	0.0	0.0	0.0	0.0	0.0	2.6	85.0
19	114.0	64.0	23.0	6.2	0.7	0.0	0.0	0.0	0.0	0.0	2.6	53.0
20	175.0	49.0	22.0	5.6	0.7	0.0	0.0	0.0	0.0	0.0	2.6	44.0
21	1,560.0	41.0	20.0	5.8	0.8	0.0	0.0	0.0	0.0	0.0	2.6	216.0
22	403.0	35.0	19.0	6.0	0.9	0.0	0.0	0.0	0.0	0.0	2.6	149.0
23	164.0	32.0	18.0	5.6	0.7	0.0	0.0	0.0	0.0	0.0	2.6	63.0
24	403.0	29.0	17.0	5.2	0.5	0.0	0.0	0.0	0.0	0.0	3.8	49.0
25	170.0	27.0	15.0	5.1	0.3	0.0	0.0	0.0	0.0	0.0	101.0	43.0
26	103.0	26.0	15.0	5.0	0.1	0.0	0.0	0.0	0.0	0.0	252.0	44.0
27	332.0	23.0	13.0	5.1	0.1	0.0	0.0	0.0	0.0	0.0	98.0	113.0
28	115.0	23.0	12.0	5.1	0.1	0.0	0.0	0.0	0.0	0.0	272.0	149.0
29	76.0		11.0	4.4	0.1	0.0	0.0	0.0	0.0	0.0	659.0	242.0
30	59.0		11.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	331.0	119.0
31	48.0		10.0		0.0		0.0	0.0		0.0		66.0
Monthly Average:	248.1	45.4	46.4	7.0	1.6	0.0	0.0	0.0	0.0	0.0	58.8	165.9
Minimum Flow:	6.9	21.0	10.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.0
Peak Flow:	1,560.0	269.0	149.0	13.0	3.3	0.0	0.0	0.0	0.0	0.0	659.0	1,200.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1971											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	54.0	19.0	8.0	26.0	6.4	1.8	0.0	0.0	0.0	0.0	0.0	0.9
2	134.0	18.0	7.0	20.0	6.0	1.7	0.0	0.0	0.0	0.0	0.0	1.9
3	54.0	17.0	6.4	17.0	6.5	1.4	0.0	0.0	0.0	0.0	0.0	2.5
4	46.0	16.0	6.8	15.0	7.1	1.2	0.0	0.0	0.0	0.0	0.0	4.8
5	42.0	15.0	6.9	13.0	7.8	1.1	0.0	0.0	0.0	0.0	0.0	4.9
6	39.0	14.0	6.4	13.0	6.9	0.9	0.0	0.0	0.0	0.0	0.0	3.8
7	36.0	14.0	6.4	17.0	5.9	0.6	0.0	0.0	0.0	0.0	0.0	2.5
8	34.0	13.0	6.4	16.0	7.2	0.3	0.0	0.0	0.0	0.0	0.0	2.3
9	32.0	12.0	6.3	12.0	9.9	0.2	0.0	0.0	0.0	0.0	0.0	2.5
10	30.0	12.0	5.9	12.0	7.3	0.2	0.0	0.0	0.0	0.0	0.0	2.4
11	40.0	11.0	6.7	13.0	5.7	0.1	0.0	0.0	0.0	0.0	0.0	2.4
12	101.0	11.0	11.0	11.0	4.8	0.1	0.0	0.0	0.0	0.0	0.0	5.0
13	368.0	11.0	40.0	9.6	4.3	0.1	0.0	0.0	0.0	0.0	0.0	8.3
14	140.0	10.0	18.0	9.7	3.9	0.0	0.0	0.0	0.0	0.0	0.0	7.1
15	70.0	10.0	13.0	9.1	3.3	0.0	0.0	0.0	0.0	0.0	0.0	3.6
16	54.0	12.0	11.0	8.3	2.7	0.0	0.0	0.0	0.0	0.0	0.0	2.9
17	51.0	13.0	9.7	9.8	2.3	0.0	0.0	0.0	0.0	0.0	0.0	2.2
18	46.0	11.0	9.0	12.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	1.7
19	43.0	19.0	8.3	8.4	1.9	0.0	0.0	0.0	0.0	0.0	0.0	1.6
20	40.0	16.0	7.1	7.7	1.9	0.0	0.0	0.0	0.0	0.0	0.0	1.5
21	37.0	11.0	6.9	8.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	1.6
22	35.0	9.6	6.4	7.5	1.4	0.0	0.0	0.0	0.0	0.0	0.0	34.0
23	33.0	9.3	9.0	7.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0	51.0
24	32.0	8.8	26.0	6.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	46.0
25	30.0	8.1	89.0	6.4	1.0	0.0	0.0	0.0	0.0	0.0	0.0	726.0
26	29.0	7.2	532.0	7.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	119.0
27	28.0	7.4	174.0	7.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	200.0
28	26.0	8.0	68.0	7.3	1.0	0.0	0.0	0.0	0.0	0.0	0.0	137.0
29	24.0		46.0	7.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	46.0
30	22.0		37.0	6.4	2.2	0.0	0.0	0.0	0.0	0.0	0.0	34.0
31	20.0		31.0		2.1		0.0	0.0		0.0		23.0
Monthly Average:	57.1	12.3	39.5	11.0	3.8	0.3	0.0	0.0	0.0	0.0	0.0	47.8
Minimum Flow:	20.0	7.2	5.9	6.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Peak Flow:	368.0	19.0	532.0	26.0	9.9	1.8	0.0	0.0	0.0	0.0	0.0	726.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1972											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	16.0	12.0	13.0	3.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	1.3
2	13.0	9.4	10.0	3.4	2.5	0.0	0.0	0.0	0.0	0.0	0.0	1.4
3	11.0	7.7	9.3	3.3	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1.5
4	9.8	6.7	9.7	3.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	1.6
5	8.6	234.0	9.1	4.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	2.0
6	7.3	336.0	8.4	11.0	2.0	0.0	0.0	0.0	0.0	0.0	0.3	3.1
7	6.5	70.0	7.3	12.0	2.0	0.0	0.0	0.0	0.0	0.0	1.7	8.2
8	5.9	39.0	6.3	7.5	2.2	0.0	0.0	0.0	0.0	0.0	1.0	25.0
9	5.4	31.0	6.4	5.9	2.2	0.0	0.0	0.0	0.0	0.0	1.3	11.0
10	4.9	22.0	7.4	5.3	1.8	0.0	0.0	0.0	0.0	0.0	2.2	6.7
11	4.7	16.0	10.0	5.9	1.4	0.0	0.0	0.0	0.0	0.0	50.0	4.8
12	4.9	13.0	7.3	19.0	1.2	0.0	0.0	0.0	0.0	0.0	23.0	4.0
13	4.7	12.0	6.4	29.0	1.0	0.0	0.0	0.0	0.0	0.0	7.4	3.5
14	4.7	10.0	6.4	16.0	0.8	0.0	0.0	0.0	0.0	0.0	37.0	3.7
15	4.5	8.9	6.1	9.9	0.5	0.0	0.0	0.0	0.0	0.0	30.0	3.5
16	4.3	7.6	5.5	8.1	0.3	0.0	0.0	0.0	0.0	0.0	230.0	3.4
17	4.3	6.8	5.0	7.0	0.1	0.0	0.0	0.0	0.0	0.0	71.0	23.0
18	4.3	6.9	4.6	5.9	0.0	0.0	0.0	0.0	0.0	0.0	21.0	44.0
19	4.3	6.4	4.3	5.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	87.0
20	4.3	6.0	4.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	6.5	43.0
21	4.3	5.6	3.8	4.3	0.3	0.0	0.0	0.0	0.0	0.0	4.7	29.0
22	4.5	12.0	4.4	4.1	0.5	0.0	0.0	0.0	0.0	0.0	3.7	57.0
23	5.3	14.0	6.3	3.6	0.7	0.0	0.0	0.0	0.0	0.0	3.0	40.0
24	11.0	9.4	5.7	5.2	0.7	0.0	0.0	0.0	0.0	0.0	2.5	81.0
25	7.2	27.0	4.5	9.1	0.5	0.0	0.0	0.0	0.0	0.0	2.1	40.0
26	6.3	27.0	4.1	6.4	0.3	0.0	0.0	0.0	0.0	0.0	1.8	30.0
27	23.0	16.0	3.8	4.7	0.2	0.0	0.0	0.0	0.0	0.0	1.6	24.0
28	46.0	13.0	3.6	3.7	0.1	0.0	0.0	0.0	0.0	0.0	1.5	40.0
29	34.0	13.0	3.4	3.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	27.0
30	22.0		3.4	2.6	0.0	0.0	0.0	0.0	0.0	0.0	1.3	18.0
31	15.0		3.3		0.0		0.0	0.0		0.0		18.0
Monthly Average:	10.1	34.4	6.2	7.2	1.0	0.0	0.0	0.0	0.0	0.0	17.2	22.1
Minimum Flow:	4.3	5.6	3.3	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
Peak Flow:	46.0	336.0	13.0	29.0	2.6	0.0	0.0	0.0	0.0	0.0	230.0	87.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1973											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	15.0	74.0	220.0	38.0	9.1	0.4	0.0	0.0	0.0	0.0	0.0	941.0
2	13.0	53.0	56.0	32.0	8.2	1.5	0.0	0.0	0.0	0.0	0.0	128.0
3	10.0	76.0	141.0	29.0	7.5	1.8	0.0	0.0	0.0	0.0	0.0	50.0
4	9.8	192.0	231.0	26.0	7.3	1.4	0.0	0.0	0.0	0.0	0.0	39.0
5	8.8	68.0	78.0	22.0	9.8	0.7	0.0	0.0	0.0	0.0	0.0	33.0
6	9.2	98.0	221.0	21.0	9.7	0.4	0.0	0.0	0.0	0.0	8.9	29.0
7	8.8	283.0	156.0	20.0	7.2	0.2	0.0	0.0	0.0	0.0	15.0	26.0
8	15.0	137.0	315.0	16.0	6.1	0.0	0.0	0.0	0.0	0.0	15.0	23.0
9	645.0	70.0	117.0	15.0	5.6	0.0	0.0	0.0	0.0	0.0	5.0	20.0
10	362.0	457.0	75.0	16.0	5.1	0.0	0.0	0.0	0.0	0.0	4.8	18.0
11	1,080.0	723.0	139.0	14.0	4.6	0.0	0.0	0.0	0.0	0.0	50.0	23.0
12	1,430.0	450.0	58.0	14.0	4.7	0.0	0.0	0.0	0.0	0.0	621.0	33.0
13	339.0	274.0	47.0	15.0	3.5	0.0	0.0	0.0	0.0	0.0	450.0	269.0
14	161.0	252.0	40.0	29.0	2.8	0.0	0.0	0.0	0.0	0.0	339.0	104.0
15	112.0	191.0	35.0	17.0	2.4	0.0	0.0	0.0	0.0	0.0	230.0	48.0
16	1,790.0	161.0	32.0	14.0	2.2	0.0	0.0	0.0	0.0	0.0	193.0	40.0
17	468.0	141.0	30.0	17.0	1.9	0.0	0.0	0.0	0.0	0.0	508.0	41.0
18	716.0	110.0	29.0	38.0	1.5	0.0	0.0	0.0	0.0	0.0	231.0	42.0
19	283.0	89.0	27.0	19.0	1.2	0.0	0.0	0.0	0.0	0.0	48.0	35.0
20	139.0	81.0	164.0	14.0	1.0	0.0	0.0	0.0	0.0	0.0	34.0	33.0
21	109.0	69.0	147.0	11.0	1.2	0.0	0.0	0.0	0.0	0.0	33.0	127.0
22	65.0	64.0	160.0	9.9	1.6	0.0	0.0	0.0	0.0	0.0	22.0	239.0
23	50.0	58.0	60.0	10.0	1.6	0.0	0.0	0.0	0.0	0.0	17.0	78.0
24	44.0	55.0	48.0	12.0	1.4	0.0	0.0	0.0	0.0	0.0	19.0	57.0
25	123.0	50.0	42.0	10.0	1.3	0.0	0.0	0.0	0.0	0.0	25.0	47.0
26	144.0	74.0	39.0	9.5	1.7	0.0	0.0	0.0	0.0	0.0	17.0	103.0
27	56.0	252.0	39.0	9.8	1.6	0.0	0.0	0.0	0.0	0.0	14.0	536.0
28	48.0	601.0	39.0	9.1	1.3	0.0	0.0	0.0	0.0	0.0	11.0	489.0
29	44.0		32.0	9.6	1.1	0.0	0.0	0.0	0.0	0.0	10.0	354.0
30	233.0		31.0	10.0	0.8	0.0	0.0	0.0	0.0	0.0	34.0	179.0
31	135.0		53.0		0.4		0.0	0.0		0.0		116.0
Monthly Average:	279.5	185.8	93.6	17.6	3.7	0.2	0.0	0.0	0.0	0.0	98.5	138.7
Minimum Flow:	8.8	50.0	27.0	9.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	18.0
Peak Flow:	1,790.0	723.0	315.0	38.0	9.8	1.8	0.0	0.0	0.0	0.0	621.0	941.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1974											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	246.0	35.0	861.0	517.0	12.0	1.2	0.0	0.0	0.0	0.0	0.0	1.5
2	96.0	32.0	758.0	314.0	11.0	1.2	0.0	0.0	0.0	0.0	3.1	1.5
3	64.0	29.0	223.0	150.0	10.0	1.2	0.0	0.0	0.0	0.0	2.8	6.4
4	117.0	29.0	111.0	81.0	9.7	1.2	0.0	0.0	0.0	0.0	2.1	25.0
5	136.0	27.0	62.0	58.0	9.3	0.9	0.0	0.0	0.0	0.0	1.6	11.0
6	459.0	24.0	50.0	50.0	8.9	0.7	0.0	0.0	0.0	0.0	1.4	6.1
7	401.0	22.0	78.0	43.0	8.5	0.5	0.0	0.0	0.0	0.0	1.6	5.8
8	175.0	22.0	163.0	41.0	8.2	0.5	0.0	0.0	0.0	0.0	2.3	5.3
9	102.0	21.0	57.0	47.0	7.2	0.4	15.0	0.0	0.0	0.0	4.9	4.7
10	66.0	21.0	46.0	45.0	6.2	0.3	27.0	0.0	0.0	0.0	2.8	4.3
11	54.0	19.0	45.0	39.0	5.3	0.2	7.5	0.0	0.0	0.0	2.0	4.3
12	87.0	19.0	207.0	40.0	4.8	0.2	3.6	0.0	0.0	0.0	1.7	4.7
13	50.0	26.0	83.0	33.0	4.6	0.2	2.2	0.0	0.0	0.0	1.5	5.3
14	61.0	20.0	54.0	30.0	4.4	0.2	1.5	0.0	0.0	0.0	1.3	5.8
15	127.0	18.0	46.0	29.0	4.3	0.3	1.0	0.0	0.0	0.0	1.3	5.3
16	100.0	19.0	42.0	26.0	4.1	0.5	0.7	0.0	0.0	0.0	1.3	4.7
17	784.0	22.0	39.0	24.0	3.8	0.6	0.3	0.0	0.0	0.0	1.3	4.7
18	305.0	17.0	38.0	23.0	3.8	0.7	0.2	0.0	0.0	0.0	1.4	4.3
19	238.0	50.0	35.0	27.0	3.8	1.3	0.1	0.0	0.0	0.0	1.5	4.3
20	173.0	36.0	32.0	23.0	3.8	4.3	0.1	0.0	0.0	0.0	1.7	4.3
21	107.0	29.0	30.0	19.0	3.6	3.6	0.0	0.0	0.0	0.0	3.8	4.3
22	63.0	69.0	29.0	18.0	3.4	1.8	0.0	0.0	0.0	0.0	25.0	4.3
23	53.0	38.0	28.0	18.0	3.2	1.1	0.0	0.0	0.0	0.0	8.0	4.7
24	47.0	32.0	27.0	46.0	2.7	0.6	0.0	0.0	0.0	0.0	4.4	3.8
25	42.0	29.0	25.0	37.0	2.2	0.4	0.0	0.0	0.0	0.0	3.4	3.4
26	40.0	28.0	29.0	26.0	1.8	0.2	0.0	0.0	0.0	0.0	3.2	4.3
27	37.0	30.0	39.0	20.0	1.6	0.1	0.0	0.0	0.0	0.0	2.5	4.7
28	35.0	28.0	64.0	17.0	1.2	0.0	0.0	0.0	0.0	0.0	2.1	5.8
29	34.0		85.0	14.0	1.1	0.0	0.0	0.0	0.0	0.0	1.9	6.4
30	32.0		355.0	13.0	1.1	0.0	0.0	0.0	0.0	0.0	1.8	5.8
31	32.0		134.0		1.2		0.0	0.0		0.0		5.3
Monthly Average:	140.7	28.3	125.0	62.3	5.1	0.8	1.9	0.0	0.0	0.0	3.1	5.6
Minimum Flow:	32.0	17.0	25.0	13.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Peak Flow:	784.0	69.0	861.0	517.0	12.0	4.3	27.0	0.0	0.0	0.0	25.0	25.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1975											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	5.3	22.0	9.4	29.0	11.0	0.3	0.0	0.0	0.0	0.0	6.0	2.4
2	4.7	352.0	11.0	25.0	11.0	0.3	0.0	0.0	0.0	0.0	4.1	2.4
3	4.7	165.0	9.3	24.0	10.0	0.4	0.0	0.0	0.0	0.0	3.8	2.4
4	4.7	323.0	8.5	26.0	14.0	0.3	0.0	0.0	0.0	0.0	2.9	2.3
5	5.1	94.0	12.0	89.0	12.0	0.3	0.0	0.0	0.0	0.0	2.0	2.6
6	22.0	51.0	25.0	89.0	9.7	0.3	0.0	0.0	0.0	0.0	1.4	2.3
7	79.0	58.0	30.0	52.0	9.9	0.1	0.0	0.0	0.0	0.0	1.8	2.5
8	165.0	93.0	71.0	39.0	9.0	0.1	0.0	0.0	0.0	0.0	2.0	2.5
9	51.0	522.0	38.0	34.0	7.4	0.0	0.0	0.0	0.0	0.0	1.8	2.6
10	31.0	304.0	31.0	30.0	6.3	0.0	0.0	0.0	0.0	0.0	2.4	2.6
11	22.0	148.0	30.0	29.0	5.7	0.0	0.0	0.0	0.0	0.0	3.2	2.6
12	16.0	150.0	24.0	26.0	5.8	0.0	0.0	0.0	0.0	0.0	3.4	3.1
13	13.0	776.0	139.0	24.0	5.5	0.0	0.0	0.0	0.0	0.0	2.6	4.1
14	11.0	152.0	161.0	23.0	4.7	0.0	0.0	0.0	0.0	0.0	2.2	4.7
15	10.0	49.0	102.0	28.0	4.4	0.0	0.0	0.0	0.0	0.0	2.3	3.6
16	8.4	34.0	174.0	26.0	4.5	0.0	0.0	0.0	0.0	0.0	15.0	3.4
17	7.3	27.0	63.0	26.0	4.6	0.0	0.0	0.0	0.0	0.2	20.0	3.0
18	6.6	21.0	46.0	17.0	3.8	0.0	0.0	0.0	0.0	4.2	8.3	3.0
19	6.4	49.0	39.0	15.0	3.2	0.0	0.0	0.0	0.0	5.6	5.4	3.0
20	6.3	72.0	40.0	14.0	2.8	0.0	0.0	0.0	0.0	6.3	4.4	2.7
21	6.4	32.0	175.0	14.0	2.7	0.0	0.0	0.0	0.0	7.1	3.5	2.7
22	6.4	23.0	329.0	13.0	2.4	0.0	0.0	0.0	0.0	7.0	3.0	4.0
23	6.1	18.0	88.0	13.0	2.0	0.0	0.0	0.0	0.0	7.0	2.6	9.0
24	5.8	15.0	127.0	16.0	1.9	0.0	0.0	0.0	0.0	7.1	2.6	5.9
25	5.8	14.0	497.0	43.0	1.7	0.0	0.0	0.0	0.0	6.6	2.6	4.5
26	5.8	12.0	144.0	25.0	1.6	0.0	0.0	0.0	0.0	14.0	2.4	3.8
27	5.6	10.0	63.0	19.0	1.4	0.0	0.0	0.0	0.0	20.0	2.7	3.6
28	5.3	9.3	45.0	15.0	1.1	0.0	0.0	0.0	0.0	6.4	2.6	3.4
29	5.1		38.0	13.0	0.8	0.0	0.0	0.0	0.0	4.3	3.0	3.2
30	4.8		34.0	12.0	0.5	0.0	0.0	0.0	0.0	7.8	2.7	3.0
31	5.5		31.0		0.4		0.0	0.0		16.0		3.0
Monthly Average:	17.5	128.4	85.0	28.3	5.2	0.1	0.0	0.0	0.0	3.9	4.1	3.4
Minimum Flow:	4.7	9.3	8.5	12.0	0.4	0.0	0.0	0.0	0.0	0.0	1.4	2.3
Peak Flow:	165.0	776.0	497.0	89.0	14.0	0.4	0.0	0.0	0.0	20.0	20.0	9.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1976											
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3.0	2.6	18.0	2.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	2.6	2.6	19.0	2.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	2.3	2.6	41.0	2.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	2.6	2.6	28.0	2.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	2.6	3.0	16.0	2.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	2.6	3.0	11.0	2.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	2.5	3.0	8.3	2.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	2.6	3.0	7.0	5.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	2.9	3.4	6.0	18.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	3.6	3.0	5.7	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	4.5	2.6	5.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	3.8	2.6	4.6	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	3.5	2.8	4.1	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	3.6	7.8	3.8	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	3.4	13.0	3.4	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	3.2	7.8	3.4	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	3.2	8.2	3.3	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	3.2	8.2	3.4	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	3.2	13.0	3.5	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	3.0	21.0	4.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	3.0	10.0	3.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	3.0	7.1	3.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	3.2	6.2	3.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	3.0	5.3	3.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	2.9	4.7	2.8	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	2.9	4.2	2.6	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	2.8	3.9	2.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	2.7	3.8	2.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	2.3	5.0	2.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	2.4		2.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	2.6		2.7		0.0		0.0	0.0		0.0		0.0
Monthly Average:	3.0	5.7	7.4	4.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Minimum Flow:	2.3	2.6	2.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peak Flow:	4.5	21.0	41.0	18.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	1977								
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.0	1.0	1.6	0.4	0.0	0.0	0.0	0.0	0.0
2	0.0	1.1	1.6	0.6	0.0	0.0	0.0	0.0	0.0
3	2.5	1.2	1.8	0.6	0.0	0.0	0.0	0.0	0.0
4	11.0	0.9	1.4	0.7	0.0	0.0	0.0	0.0	0.0
5	3.5	0.9	1.4	0.5	0.0	0.0	0.0	0.0	0.0
6	1.9	1.1	1.1	0.5	0.0	0.0	0.0	0.0	0.0
7	1.2	1.2	0.8	0.6	0.0	0.0	0.0	0.0	0.0
8	1.0	1.5	0.8	0.6	0.0	0.0	0.0	0.0	0.0
9	0.8	2.3	1.1	0.5	0.0	0.0	0.0	0.0	0.0
10	0.7	2.3	1.5	0.4	0.3	0.0	0.0	0.0	0.0
11	0.7	2.1	1.9	0.4	0.3	0.0	0.0	0.0	0.0
12	0.7	1.4	2.2	0.5	0.6	0.0	0.0	0.0	0.0
13	0.8	1.3	2.0	0.4	0.4	0.0	0.0	0.0	0.0
14	0.9	1.4	2.0	0.2	0.2	0.0	0.0	0.0	0.0
15	1.2	1.0	2.4	0.1	0.1	0.0	0.0	0.0	0.0
16	1.0	0.7	4.1	0.0	0.0	0.0	0.0	0.0	0.0
17	0.8	0.6	3.4	0.1	0.0	0.0	0.0	0.0	0.0
18	0.9	0.7	3.8	0.0	0.0	0.0	0.0	0.0	0.0
19	1.0	0.6	2.8	0.0	0.0	0.0	0.0	0.0	0.0
20	1.1	0.5	1.7	0.0	0.0	0.0	0.0	0.0	0.0
21	1.2	1.5	1.2	0.0	0.0	0.0	0.0	0.0	0.0
22	1.3	10.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
23	1.2	8.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0
24	1.0	5.5	1.3	0.0	0.0	0.0	0.0	0.0	0.0
25	0.8	4.7	1.2	0.0	0.0	0.0	0.0	0.0	0.0
26	0.9	2.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
27	1.3	1.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0
28	0.9	1.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0
29	1.0		0.8	0.0	0.0	0.0	0.0	0.0	0.0
30	1.1		0.9	0.0	0.0	0.0	0.0	0.0	0.0
31	1.3		0.6		0.0		0.0	0.0	
Monthly Average:	1.4	2.2	1.6	0.2	0.1	0.0	0.0	0.0	0.0
Minimum Flow:	0.0	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Peak Flow:	11.0	10.0	4.1	0.7	0.6	0.0	0.0	0.0	0.0

DEER CREEK NEAR SLOUGHHOUSE, CA

USGS Gage Number 11335700

Year	(All)												
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1	38.2	103.8	118.0	48.2	6.2	0.7	0.0	0.0	0.0	0.0	0.6	93.1	
2	27.7	61.2	82.1	33.4	5.8	0.7	0.0	0.0	0.0	0.0	0.6	63.6	
3	43.8	39.3	46.9	22.1	5.4	0.7	0.0	0.0	0.0	0.0	0.8	20.4	
4	62.0	51.6	45.7	16.4	5.6	0.6	0.0	0.0	0.0	0.0	2.0	82.5	
5	52.7	50.9	29.5	37.5	5.6	0.6	0.0	0.0	0.0	0.0	0.9	25.0	
6	125.7	109.1	59.6	79.1	5.3	0.5	0.0	0.0	0.0	0.0	1.2	12.0	
7	82.9	53.3	40.7	51.0	5.0	0.5	0.0	0.0	0.0	0.0	1.9	8.6	
8	41.0	36.6	63.3	25.7	4.6	0.4	0.0	0.0	0.0	0.0	1.8	9.7	
9	63.8	71.6	31.3	32.2	4.6	0.5	0.9	0.0	0.0	0.0	2.7	7.9	
10	49.2	157.6	31.1	65.3	4.0	0.5	1.7	0.0	0.0	0.0	8.2	6.5	
11	92.0	106.1	28.1	31.5	5.3	0.5	0.5	0.0	0.0	0.0	9.9	10.2	
12	118.6	73.9	36.1	21.5	4.2	0.5	0.2	0.0	0.0	0.0	49.1	9.6	
13	149.5	137.2	36.2	18.2	3.6	0.4	0.1	0.0	0.0	104.4	31.2	23.3	
14	140.7	88.5	30.8	64.9	3.4	0.3	0.1	0.0	0.0	43.8	25.5	17.3	
15	51.0	92.2	34.5	35.6	3.3	0.3	0.1	0.0	0.0	3.5	28.4	14.0	
16	198.4	49.0	41.2	39.1	2.8	0.2	0.0	0.0	0.0	1.5	30.1	28.8	
17	152.1	51.4	32.6	21.7	2.5	0.2	0.0	0.0	0.0	1.0	38.9	27.2	
18	95.7	40.6	21.8	17.3	2.2	0.2	0.0	0.0	0.0	0.9	17.7	16.4	
19	135.2	44.5	17.8	15.5	2.0	0.2	0.0	0.0	0.0	0.8	8.6	19.2	
20	185.1	74.5	25.0	13.7	1.9	0.4	0.0	0.0	0.0	0.7	36.2	45.7	
21	247.4	45.5	33.4	13.8	1.8	0.3	0.0	0.0	0.0	0.8	6.9	97.6	
22	119.3	30.7	41.8	11.2	1.9	0.2	0.0	0.0	0.0	0.7	5.3	143.1	
23	44.0	53.7	21.6	11.4	1.8	0.1	0.0	0.0	0.0	0.7	12.1	131.6	
24	64.1	48.7	24.8	12.7	1.6	0.1	0.0	0.0	0.0	0.7	13.4	87.7	
25	87.7	58.5	50.6	12.8	1.5	0.1	0.0	0.0	0.0	0.7	12.6	111.0	
26	76.5	48.8	55.0	10.7	1.3	0.0	0.0	0.0	0.0	1.1	20.1	54.5	
27	46.7	38.4	46.1	9.3	1.3	0.0	0.0	0.0	0.0	1.5	9.5	84.4	
28	34.8	71.0	96.8	8.1	1.1	0.0	0.0	0.0	0.0	0.6	19.7	85.6	
29	27.9	9.3	32.6	7.4	1.0	0.0	0.0	0.0	0.0	0.5	43.5	95.1	
30	99.0		40.3	6.8	0.9	0.0	0.0	0.0	0.0	0.7	24.4	62.6	
31	131.2		25.0		0.8		0.0	0.0		1.2		69.2	
Monthly Average:	93.0	66.9	42.6	26.5	3.2	0.3	0.1	0.0	0.0	5.3	15.5	50.4	
Minimum Flow:	27.7	9.3	17.8	6.8	0.8	0.0	0.0	0.0	0.0	0.0	0.6	6.5	
Peak Flow:	247.4	157.6	118.0	79.1	6.2	0.7	1.7	0.0	0.0	104.4	49.1	143.1	

USGS 11335000: Cosumnes River at Michigan Bar, Water Year 1907-2001 (cubic feet per second)

	Month											
Data	1	2	3	4	5	6	7	8	9	10	11	12
Average of Flow	949	1,204	1,199	1,059	688	254	61	21	15	32	139	431
StdDev of Flow	2,269	2,105	1,546	1,026	591	265	72	22	20	123	654	1,444
Min of Flow	16	16	31	23	12	1	0	0	0	0	0	10
Max of Flow	61,600	34,400	18,700	20,100	6,900	1,810	738	166	335	5,750	16,700	31,700
Median	233	622	774	833	548	166	43	12	7	19	45	92

USGS 11335000: Cosumnes River at McConnell, Water Year 1941-1982 (cubic feet per second)

	Month											
Data	1	2	3	4	5	6	7	8	9	10	11	12
Average of Flow	1,198	1,135	1,236	1,187	728	230	38	4	3	21	170	608
StdDev of Flow	2,388	1,634	1,703	1,519	578	250	63	11	13	197	930	2,160
Min of Flow	0	0	0	0	0	0	0	0	0	0	0	0
Max of Flow	19,600	17,300	24,500	25,800	3,110	1,440	602	103	231	6,320	20,900	35,600
Median	275	606	764	869	602	152	10	0	0	0	36	93

Note: For Full Historic Data Tabeles Please contact Kelly Briggs at (916) 255-3090